MESOSCALE SPATIAL AND TEMPORAL VARIATIONS OF WATER MASS CHARACTERISTICS IN THE CALIFORNIA CURRENT REGION OFF MONTEREY BAY IN 1973-1974

Richard Edward Blumberg

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THESIS

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by

Richard Edward Blumberg

September 1975

Thesis Advisor: Jacob B. Wickham

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Mesoscale Spatial and Temporal Variations of Water Mass Characteristics in the California Current Region Off Monterey Bay in 1973-1974

by

Richard Edward Blumberg
Lieutenant, United States Navy
B.S., University of Maryland, 1967

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I. INTRODUCTION

A. CALIFORNIA CURRENT SYSTEM

The California Current system has been described in terms of three general periods based on the particular dominant feature which occurs during that part of the year. The three periods are: the Davidson period (mid-November to mid-February), the upwelling period (mid-February to the end of July) and the oceanic period (end of July to mid-November). The different conditions that exist during these periods are the result of the offshore currents and the predominant winds [Sverdrup, Johnson, and Fleming, 1942].

Two currents are important. The first, the California Current, is formed by parts of the North Pacific Current and the Subarctic Current and flows southward along the west coast of the United States between 48°N and 23°N. The current is wide and flows sluggishly to the southeast until, off Central America, the current turns west and becomes the North Equatorial Current.

The second important current is the relatively warm Davidson Current. This is a coastal countercurrent inshore of the California Current along the west coast of the United States [Glossary of Oceanographic Terms, 1966]. It may be present as a surface or as a subsurface current and has also been called the California Countercurrent by some investigators.

The California Current system is found between a cell of high atmospheric pressure to the west and a low pressure cell over the land to the east. The western cell often dominates; thus the winds over the California Current are generally from the north and west. These pressure cells change their relative positions and strengths, and cause a seasonal variation in the winds along the coast. For example, between spring and fall the winds are primarily northerly. When strong enough and combined with the Coriolis Force this wind drives the surface water away from the coast giving rise to upwelling. In the winter the northerly component of the wind weakens or reverses. This corresponds to the period when the Davidson Current flows northward on the surface [Edmisten, 1974]. In addition to the variability in the current structure due to the interaction with the local wind, other factors, including changes in global scale wind patterns, contribute to both the long term and the short term changes in the water mass distribution.

B. PREVIOUS STUDIES

The distribution of the water masses and the interaction of the current off the west coast of California have been examined by a number of investigators whose works are summarized by Molnar, Brown, and Edmisten. Only some of the more interesting characteristics of water mass distribution within the California Current system will be described here.

The nature of the Davidson Current changes with the season. During the Davidson period the countercurrent is present at all depths on the coastal side of the California Current to at least 48°N latitude. The upper homogeneous layer is relatively thick, that is, the temperature at 25m is nearly the same as the surface temperature and at 50m the temperature is only slightly lower [Sverdrup, et al., 1942]. Satellite reconnaissance of the California coastal currents between July 1972 and May 1974 provides an additional source of information on the surface current patterns. The ERTS-1 (Earth Resources Technology Satellite) imagery analysis of the Monterey Bay area showed a very uniform surface current pattern during the Davidson Current period. The horizontal variation was very slight although no regular pattern of water mass distribution was discernible. The northward flowing Davidson Current was not observed to be present within about 30 km offshore during November and December 1973. However, it was recorded to be present on the surface in January and February 1973 [Pirie, and Steller, 1974].

As the winds shift to the north, or northwest in early spring the Davidson Current breaks up into a series of eddies as upwelling intensifies [Brown, 1974]. The Davidson Current is still present below 200 to 250 m, and according to Sverdrup, in the absence of the winds which cause the upwelling, the Davidson Current would be present on the surface. The upwelling period is characterized by a rise in the

isotherms toward the coast where the temperature is about 3° C lower than further offshore. The water which is carried toward the surface is from the upper 200m. Below 200m the slope of the isotherms is opposite to those in the surface layer. This downward slope may be indicative of a reversal of current direction toward the north [Neumann and Pierson, 1966].

During the Oceanic period the California Current is dominant throughout the area of survey. However, the Davidson Current is still present at depth.

The ERTS-1 imagery analysis illustrated the complexity and variability in the current structure. Several months showed both warm and cold components to be present offshore (January and February 1973), while other months indicated no definite flow direction but showed a series of gyres and area of mixture of the water of the two currents (April, September, October, November and December 1973) [Pirie, et al., 1974]. This complex structure is in agreement with the work of Scripps Institution of Oceanography as reported by Sverdrup. In the areas of intense upwelling tongues of water of low temperature extend southward away from the coast and between these tongues are higher temperature tongues extending in toward the coast. The flow within the warm tongues is directed toward the north and the flow within the cold tongues is directed toward the south.

Reid, Roden and Wyllie [Brown, 1974] described four water masses that contribute to the California Current system. The Subarctic Water Mass and the Central Water Mass come in from the west and northwest. The Davidson Current is from the Equatorial Water Mass to the south. The fourth water mass is the result of the upwelling process along the coast. This classification scheme was later simplified to a "northern" water mass called Subarctic North Pacific Water and a "southern" water mass called Equatorial Pacific Water [Brown, 1974].

The terms "northern" and "southern" water will be used in this paper to describe the water mass characteristics in the area of study, rather than their places of origin. Northern water is water which appears colder and less saline than the water of the same density surrounding it. Similarly, southern water is water which is relatively warmer and saltier than the surrounding water of the same density.

C. OBJECTIVES

The primary goal of this study is to describe the annual variation in the structure of the water mass distribution in the area of survey and to document the procedure which was used to process the data. This description is based on a year's monthly observations using continuous profiling sensors. Specifically, the following points are discussed:

1. A procedure for processing a large quantity of analog salinity, temperature and depth (STD) data and expendable bathythermograph (XBT) data is described.

2. Two computer programs to process this data were modified and are documented in Appendices D and E.

3. The water mass distribution is examined on a small spatial scale (5 km between stations) in order to see on what scales the variation occurs.

4. The extent of the survey area is considered and its sufficiency to describe the water mass distribution is discussed.

5. The water mass properties were observed once a month for 13 months in order to describe the annual variation in the water masses.

II. DATA COLLECTION AND PROCESSING

A. DATA COLLECTION

The oceanographic research vessel, Acania, was used to collect data monthly from August 1973 to August 1974 under the supervision of J. B. Wickham of the Naval Postgraduate School. The instrumentation, navigation, and data collection procedures are detailed in Reference 10. Briefly, a Bisset-Berman continuous profiling salinity, temperature, depth recorder (STD) was used to collect data during the months August 1973 through January 1974, and August 1974. From February through July 1974, the STD was inoperative and data were collected using expendable bathythemographs (XBT). No data were collected in April 1974 and insufficient data were collected in September 1973 due to inclement weather. Independent measurements of salinity and temperature were made at selected depths using Nansen bottles, a conductivity salinometer, and reversing thermometers during both the STD and the XBT cruises.

Figure 1 shows the area which was examined and Figure 2 shows the location of the stations, although not all of the stations were sampled each month. As noted in Reference 10, the use of a station spacing of 5 km is a finer grid than is traditionally used in oceanographic survey work but it is necessary to define narrow streams of northern and southern water.

B. CALIBRATION

The vertical definition as a result of collecting the data with the Bisset-Berman continuous profiling STD is estimated to be a few meters or less. This is based on a rate of drop of about 30 meters per minute.

After the data had been collected the STD and XBT traces were compared with the reversing thermometer temperatures or the salinities from the Nansen bottles to determine if a temperature correction (TCOR) or a salinity correction (SCOR) was necessary. TCOR was determined by plotting the value of temperature from the trace, T_{STD} or T_{XBT}, along one axis against the temperature from the reversing thermometers, T_N, along the other axis for the same depth. The number of points plotted was a function of the number of Nansen casts taken at all stations for the particular month in question. If T_{STD} and T_N were the same for each point, a 45° line through the origin would connect the points. If the best fit line did not pass through the origin the constant correction, TCOR, was applied to shift the line back to the origin.

$$TCOR = T_N - T_{STD}$$

The salinity correction, SCOR, was determined in a similar manner using the salinity of the water in the Nansen bottles and the salinity on the STD traces.

$$SCOR = S_N - S_{STD}$$

The XBT traces were standardized to reversing thermometer temperatures in a similar manner except that TCOR was determined from the Y intercept of a straight line through the various points computed by the WLQP2 subroutine in the W. R. Church Computer Center subroutine library. WLQP2 is a least square polynomial fit and, by calling for the best fit first order polynomial, a straight line through the data points is produced. The data points were again determined by using the temperature from the XBT trace and the temperature from the reversing thermometer of the Nansen casts at the same depth.

During several months there were no Nansen casts taken at the XBT stations. However, there were a number of stations at which both STD and XBT data were collected, and still other stations at which Nansen and STD data were collected. This enabled a determination of the temperature correction, TCOR, for the STD data as explained above:

$$\mathrm{TCOR} = T_N - T_{STD}$$

The XBT data were then compared to the corrected STD data and a constant correction, XBTCOR, was determined and applied to the XBT data for that particular month.

$$\mathrm{XBTCOR} = T_{STD} - T_{XBT}$$

Generally, the XBT temperatures were higher than the STD temperatures and, by applying the XBTCOR correction, a reasonable comparison between STD and XBT data can now be made.

One final check on the corrected data was conducted after the processing computer programs, DIGISTD and DIGIXBT, had been run. The computer printouts for a number of stations were examined at randomly selected depths. These values of temperature or salinity were compared with the values read from the traces. The computer printouts and the traces were in agreement after the constant correction, TCOR, SCOR or XBTCOR, had been applied.

C. DATA PROCESSING

To prepare the data for analysis the STD and XBT traces were examined visually, smoothed by removing spurious spikes, and marked for ease of digitizing. They were then taken to Fleet Numerical Weather Central, Monterey, where the data were converted from analog to digital form using a Calma Company digitizer. Operation of the Calma digitizer is explained in Appendices A and B. The digitizer records the data on a 556 bpi, 7-track magnetic tape which was then processed at the W. R. Church Computer Center using the appropriate program, DIGISTD or DIGIXBT. The computer programs are listed and explained in Appendices D and E. The resulting output is a listing by station of depth and temperature for the XBT data. The STD output consists of a listing by station of depth, temperature, salinity and the calculated value of sigma t. Sound velocity is also calculated for the STD traces but will not be discussed in this paper. The computer output can be

in one of several forms: a paper printout, a punched card printout or a 9-track magnetic tape. The 9-track tape was used to supply the data for the plotting programs XBTPLT or STDPLT which are listed in Appendices F and G.

1. Trace Preparation

The individual STD or XBT traces were treated in the same general manner. The STD salinity trace required special preparation since spikes are artificially introduced in the salinity trace by the equipment [Wickham, 1975]. The up and down traces were stapled together so the traces were superimposed. If a spike appeared on one trace and not on the other or if two spikes were oriented oppositely, they were ignored. The down trace was then outlined in pencil to make it easier for the digitizer operator to record the data. The XBT and STD temperature traces were traced only in areas where the original ink was difficult to see because it was smeared or too light to be digitized easily. A small circle was drawn to mark the beginning and end of each segment of the trace. A segment is an entire section of the trace recorded at a single set of depth, temperature and salinity scales. If one scale changes, the pen drawing of the STD trace is repositioned and a new segment is started.

2. Calma Digitizer

The Calma Company Model 480 digitizer reduces analog graphical data to digital form for computer processing and analysis. Two machines were used to process the data and

are located at the Fleet Numerical Weather Central, Monterey, California.

Reference 2 describes the operation of the digitizer. To digitize analog graphical data directly onto computer-compatible magnetic tape, the operator manually traces the graphical data with a movable stylus/carriage assembly. The location of the stylus is transmitted through cables to magnetic reluctance encoders, which convert stylus movement to digital signals. The signals are processed and formated for output on a 556 bpi, 500 cps, magnetic tape. Also recorded on the tape, through a manual keyboard entry, are the required identification codes such as station number, month, scaling factors, inter-record gap, error correction and others as desired, which are used by the final processing computer programs.

The maximum sampling interval for the STD data was 0.02 inch of stylus movement in either the X or Y direction. This sampling interval is a function of the stylus speed and, for most of the data, the stylus position was recorded at every .01 inch. The .02 inch sampling interval corresponds to a maximum depth change between recorded data points of approximately .66 m for the 0 to 300 m scale, and 1.75 m for the 0 to 750 m scale. The maximum temperature change between data points is about .01°C, and the maximum salinity change between data points is about .004 ppt.

For the XBT data the .02 inch corresponds to a maximum depth change between recorded data points of 2.0 m and a temperature change of .1°C. The Calma digitizer itself has a maximum absolute error of .012 inches or 0.1%. In summary, the error introduced during the digitizing procedure is more significant for the XBT data than the STD data but is still very slight over the range of depth and temperature.

III. RESULTS

Figures 3 through 19 are vertical cross sections of the area of survey showing the isotherms between 6.5°C and 12.0°C for each month. Figures 3 through 9, and 19 are based on the STD data and have lines of constant sigma t (isopycynals) plotted in addition to the isotherms. The XBT data are the basis for Figures 10 through 18 and, since there were not enough Nansen stations to determine the salinity distribution, the density structure is not shown.

The figures were plotted by using the CONTUR subroutine from the W. R. Church Computer Center subroutine library. This program does not allow for gaps in the data. Therefore, the depth of the plots is limited to the depth of the shallowest station taken during each month. In certain cases a particular station was either too shallow or the data were too unrealistic to be plotted, or there were no data taken for that particular station at all. The net result is that the figures must be examined carefully because the station spacing is not uniform. The stations appear uniformly spaced even if the actual distance between stations is not constant.

The shaded areas on the figures represent the major areas of northern and southern water. For example, in Figure 3 the warm southern water is characterized by isotherms which dip below the 26.7 sigma t surface at stations 110 and 111. This slope of the isotherms is much steeper than the depression in the 26.9 sigma t surface just below and indicates the

presence of water which is warmer than the adjacent water of the same density and depth at station 109.

The cold northern water has isotherms which slope upward more steeply or rise up above the constant sigma t surface. This is particularly evident in Figure 3 at station 108 on the 26.3 sigma t surface. At the other density surfaces for station 108 the isotherms and density surfaces both slope upward in the same general direction but the slope of the isotherms is more pronounced. The difference in the slopes of the isotherms and the isopycnals is important because it differentiates between local vertical motion due to internal waves or upwelling and differences in water mass structure due to horizontal advection.

An exception to this which is particularly important in analyzing the XBT data is the apparent slope in the isotherms which is due to bad data. For example, station 303 in Figure 12 has each isotherm depressed through the entire water column giving the appearance of being a relatively warm water intrusion. Because the depression is limited to the one station and appears over the entire 450 m depth, it is probably due to a faulty XBT, a misaligned recording trace, or improper digitizing.

Another problem which is unique to the XBT is illustrated in Figure 17 between stations 202 and 204. The surface values down to a depth of about 300 m appears to be normal in that the isotherms are horizontally consistent. Below 300 m an

apparent narrow warm intrusion appears at station 204. This anomaly is probably instrumental since the adjacent station 203 is consistent with station 205. The problem is that the XBT has a limited quantity of wire available. The recommended depth for this group of sensors was 450 m. If the wire is tangled or if the probe goes deeper than the wire is long, the wire will be stretched for a period of time before it breaks. When this wire is stretched, the recorded temperature becomes erratic. It is difficult to differentiate a real change in temperature from this artificial anomaly. In order to validate this sort of temperature change at depth, some sort of independent measurement is required, perhaps with another XBT or with a Nansen bottle and reversing thermometers. Although a number of Nansen casts were made, there were none taken at these stations. Because there are no isopycnals nor enough independent measurements to verify the structure indicated by the isotherms, it is not possible to state positively whether a specific feature is real or artificial. The following figures contain structures which appear to be the result of bad or stretched XBT's: Figure 12 - station 303, Figure 14 - station 315, Figure 17 - stations 204 and 202, and Figure 18 - station 312.

The figures will be discussed now in terms of the three oceanographic seasons. Figures 3, 4, and 5 are from August 1973. This is during the oceanic period which is from July through November. They show the presence of the southern

water below 200 m in the southern section of the area of survey. The warm water is present about 45 km offshore in Figure 3. Figure 4 is from the stations 20 km to the north where the warm water is present about 30 km off the coast. However, the warm water is scarcely indicated at all in Figure 5 which is 20 km further north. This shows the diversity in the nature of the water mass distribution. It is not known if the warm water is present further to the west, deeper than 500 m (which is unlikely) or just missing. This would indicate that the warm water to the south is merely part of a filament or gyre that only reached so far north or is discontinuous.

Figures 6 and 7, also from the oceanic period, show the presence of the warm southern water on the western boundary of the area of survey. It is still 100 m below the surface. In both cases a large cold water mass is adjacent to, and on the coastal side of, the warm water.

The Davidson period is between November and February. Figures 7, 8, 9 and 10 correspond to this period and show the presence of southern water at depth. The Davidson Current was expected to be observed on the surface at least in January and February as reported for the previous year in Reference 8. Figure 9 does show a warm water area near the surface in January 1974.

The upwelling period from February to July corresponds to Figures 10 through 18. The upwelling is expected to be

confined to the upper 200 m, and may be a very localized feature. The isotherms are expected to slope upward on the coastal side of the graphs. February (Fig. 10), May (Figs. 13 and 14), and possibly June (Fig. 15) do show upwelling at the eastern boundary. However, it is not clear from the graphs what the nature of the structures are since there are no data further east.

Another prominent feature exhibited on the graphs from May to July is a large warm water mass below 200 m on the eastern edge of the area of survey. Some downward sloping of the isotherms is expected below the areas of upwelling in the presence of a countercurrent as suggested in Reference 7. This theory is further supported by the existence of the same sort of large warm water structure which is seen in Figure 19 for August 1974. The data in Figure 19 are supported by the density structure in that the isotherms and isopycnals do diverge and this indicates the presence of relatively warmer and saltier water.

A comparison of the structure between August 1973 and August 1974 is of interest. August 1973 (Figures 3, 4 and 5) was discussed earlier. The warm water masses are distributed in relatively small areas to the west and central portions of the survey area and very little warm water is present in Figure 5 for the northern stations. The cold northern water is present in August 1973 and is very strong for the 100 and 200 series stations. August 1974 exhibits

structure which is sharply different in that a large mass of warm water is present on the eastern boundary of the survey area and no cold water is obvious. The warm water is present at depth, which is consistent with the previous year and is as expected during the oceanic period. The difference between the months illustrates that although there may be a long time average annual cycle, the short term deviations are very large.

In summary, the data processing procedures to handle a large quantity of analog temperature and salinity data were developed and are detailed in the appendices. This study shows one year's variation in the water mass distribution off the California coast. The nature of these variations dictates the study be made on a small spatial scale. Many of the critical features are less than 10 km wide. The north to south variation is significant as is shown by the data from August 1973. Southern water structures present along the southern line of stations are not present along the same line just 40 km to the north. This suggests that the warm and cold water masses are part of a gyre or filament system as opposed to a strong central cored current.

The area of survey does not appear to be extensive enough to record all of the significant features. Upwelling is indicated on the eastern boundary of several figures but the exact nature of this feature is undetermined. Similarly, many features are identified on the western boundary but the

westward extent is now known and is certainly of interest. Finally, the difference in water mass structure between August 1973 and August 1974 suggests that the secular variation is significant. This is to be expected since the surface current characteristics, direction and speed depend on the prevailing meteorological conditions, which also have a large secular variation.

IV. RECOMMENDATIONS FOR FURTHER WORK

The data show areas which support the concept of three basic oceanographic seasons. However, the boundaries do indicate that areas of interest may lie outside of the area of survey. It is recommended that on future cruises data be collected over a wider area, both to the east and the west.

Between February and July 1974, the STD was inoperative. On future cruises if the STD is not operating, it is recommended that a greater number of Nansen casts be made. This would provide independent information on the density structure and also the reversing thermometers would serve to verify the temperatures recorded by the XBTs.

It is also recommended that an initial on board data analysis be made. This makes possible validation of questionable XBT data by means of an immediate resurvey.

One area of study which was not considered here is the short term temporal variation in the water mass distribution. The data from the monthly cruises may not be representative of the predominant conditions that exist in any one month, but may be the result of recent local weather or storm conditions. Although such a survey may be expensive in both time and money, it would provide valuable information on the structure of the water mass variability.

APPENDIX A

DIGITIZING PROCEDURE

The procedure for using the Calma digitizer will be described for an STD trace but is applicable to an XBT trace as well. The only difference is that the XBT trace is complete in one segment, and the STD trace usually requires multiple segments, which correspond to scale changes of depth (D), temperature (T) or salinity (S). Typically, an STD trace consists of three or four temperature segments and two salinity segments. The term record is used to describe a single complete entry on the digitizer tape. This record may be either a header label, which identifies the station and scale factors for the data which follow, or a trace segment which is the actual digitized data for a segment of T verses D, or S verses D. Appendix B is a checkoff sheet which was used when digitizing the data.

Once the machine is turned on and the magnetic tape is loaded, the first STD trace is taped to the table surface so it will not slip. It is aligned so that the X axis of the digitizer is parallel to the depth axis of the trace and the Y axis is parallel to the temperature/salinity axis. It is important that the trace be rotated 90° and aligned in this manner because DIGISTD and DIGIXBT expect to process data obtained from a trace with this orientation. (The orientation is used because it is easier to control the digitizer stylus

moving left to right for a continuous change in depth than for movement from top to bottom.)

The digitizer has two modes of operation, keyboard and tracer modes. The keyboard mode is used for entering the header label (identification) information on the tape for the data which is digitized and put on the tape when the machine is in the tracer mode. The first thing entered on the tape is the header label for the first station. The elements of the header are named for the acronyns used in the DIGISTD program.

Each of the eleven elements of the header is punched and entered on the tape. No blank spaces are allowed. A typical header is shown in Table I. The keyboard symbol and the inter-record gap (IRG) are put on the tape by pushing these keys on the keyboard. The keyboard symbol marks the beginning of the header and the IRG marks the end of the record.

⌐301k9910430IRG

SYMBOL	NAME	EXPLANATION
⌐	-	keyboard symbol
301	ISTAA	station number
K	AMONT	month designation code
99	IDENT	identifies record as a header
1	IDSCL	depth scale 1
0	ICODE	temperature trace
4	ITSCL	temperature scale 4
3	ISCL	salinity scale 3
0	IP	do not print this station yet
IRG	IRG	inter-record gap

TABLE I. Typical Header Label. This is the first temperature trace segment of an STD trace.

The first three elements of the header comprise a three digit number, called ISTAA in the computer programs. These elements identify the station at which the data were taken. The fourth element of the header is a one letter code called AMONT. This code identifies the particular month and year of the data. The fifth and sixth elements of the header are 99. This is an identification code, called IDENT, used to designate the header label as a header, if the keyboard symbol is missing. If the fifth and sixth characters are not 99 and there is no keyboard symbol, the record is treated as a trace. The next element of the header is called IDSCL in the programs and represents the depth scale at which the data were recorded. DIGISTD allows for three depth scales, a "1" is for a scale from zero to three hundred meters, a "2" is for a scale from zero to seven hundred and fifty meters, and a "3" is for zero to fifteen hundred meters. DIGIXBT has only one scale, a "1". The eighth element of the header is either a "0" or a "1". This element, ICODE, identifies the trace that follows as either a temperature or a salinity trace. In DIGIXBT ICODE is always "0". The ninth and tenth elements of the header are scaling factors for the temperature and salinity scales of the STD which were used when the data were recorded. Table II shows the temperature and salinity scales that are available and are allowed by the DIGISTD program. Only four temperature scales, 2, 3, 4 or 5, and two salinity scales, 3 or 4, were used to record the data. ITSCL and ISCL are both "1" for

DEPTH SCALES

IDSCL=	DEPTH RANGE
1	0 to 300 m
2	0 to 750 m
3	0 to 1500 m

TEMPERATURE SCALES

ITSCL=	TEMP RANGE
1	-2 to 3°C
2	2 to 7°C
3	6 to 11°C
4	10 to 15°C
5	14 to 19°C
6	18 to 23°C
7	22 to 27°C

SALINITY SCALES

ISCL	SALINITY RANGE
1	30.0 to 32.0 ppt
2	31.5 to 33.5 ppt
3	33.0 to 35.0 ppt
4	34.5 to 36.5 ppt
5	36.0 to 38.0 ppt
6	37.5 to 39.5 ppt
7	30.0 to 40.0 ppt

TABLE II. Depth, Temperature, and Salinity Scales.

the DIGIXBT program since there were no temperature scale changes for the XBT trace and no salinity scale at all.

The last element of the header directs the printing of the data. The data are desired only after all segments of a trace have been processed. The stored data are printed out if IP is "1" but not if IP is "0". IP is set equal to "1" only on the last salinity header for a particular STD station. Again, since the XBT trace is a single segment trace, the variable IP is always "1".

After the header label is complete and the IRG key is pushed, the stylus is moved to the origin of the trace. The origin is defined as the intersection of the depth axis with a line perpendicular to it, drawn from the beginning of the trace. The beginning was marked when the data was collected and corresponds to the sensor being at the sea surface. The origin should be marked before the digitizing process starts so it can be located easily. This origin location is necessary because the pen is not always started at the zero meter mark on the record paper. Also, the pens for salinity and temperature are offset from each other about one-eight of an inch to avoid interference between the pens.

When the stylus is on the origin, the tracer mode is activated. The digitizer is then recording the movement of the stylus as it is moved from the origin to the beginning of the trace segment. The beginning of the trace segment is flagged by pressing the "B" and the "A" keys, and then entering this

"BA" on the tape. The stylus is then traced down the segment to its end where an IRG is put on the tape. The digitizer is placed in keyboard mode by pushing "skip" (activate) and then "keyboard". The "skip" button either activates or deactivates the trace accumulator. With skip activated, the stylus may be moved while in tracer mode without changing the digital record.

Digitizing errors may be corrected as follows: The "delete record" key is used when an error has been made when making either a keyboard or a tracer record. The programs process a delete record by ignoring all the data on the tape between the delete record entry and the last previous IRG. The programs begin processing the data put on the tape after the delete record. In this way a minimum of work has to be redone in the event of an error. Because an error in the heading can be overridden by data cards in the processing programs, numerical errors in the heading code should not be corrected by the delete record procedure. Heading errors are detected by using the TAPEOUT program that is explained in Appendix C. The TAPEOUT printout is compared with the desired header to ensure that the codes are correct.

This process of header label followed by trace is continued until all the segments of a trace are recorded. At the end of the tape the "EOF" (end of file) button located on the tape recorder is pushed three times to mark the end of the data on that tape. The tape is rewound and taken to the

W. R. Church Computer Center for processing by way of the DIGISTD or DIGIXBT programs.

APPENDIX B

DIGITIZER OPERATOR PROCEDURES CHECK-OFF SHEET

The following list is a check-off sheet which is a useful guide when using the digitizer.

1. Initial conditions

   A. Transformer on

   B. X-Y plotter off

   C. Tape recorder is left on at all times since power is supplied from the transformer.

2. Load tape

   A. Ensure write permit ring is inserted in tape reel.

   B. Load tape and run forward to the load point by pushing load forward button.

3. Turn the X-Y plotter on (aural tone is heard).

   A. Press record error (aural tone deactivated).

   B. Ensure skip button is lit (activated) and press keyboard.

4. Mount STD or XBT Trace.

   A. Align grid of trace to X-Y plotter by locking X and aligning Y with axis.

   B. Ensure depth increasing in X direction and temp/salinity increasing in Y direction.

   C. Secure trace with masking tape.

5. Enter eleven keyboard entries. (Listing of header labels should have been prepared before digitizing started.)

6. Press IRG.

7. Ensure stylus on previous marked origin.

8. Press trace, deactivate skip.

9. Move stylus from origin to beginning of trace segment.

10. Flag trace by pressing "B" "A" and "enter".

11. Trace segment with stylus.

12. At end of trace, press IRG, press skip and press keyboard.

13. Repeat steps 5 through 12 for all trace segments on this trace and then go on to the next trace.

14. At the end of the day

    A. Ensure skip and keyboard were pressed.

    B. Press EOF (end of file) gap button on the tape recorder three times.

    C. Move the stylus into the lower right hand corner of the table.

    D. Rewind the tape to the load point.

    E. Turn off the X-Y plotter.

    F. Hand wind tape past load point to dismount tape reel.

    G. Turn off the transformer.

Caution: Sudden or very rapid movement of the stylus may cause the cables to come off their pulleys resulting in calibration errors.

APPENDIX C

TAPEOUT

A technical note [Raney, 1973] describes the procedure for using the IBM System / 360 model 67 computer to process 7-track tapes and describes several programs which are useful in processing the tape.

The first program that was run on the 7-track tape was a TAPEOUT program. TAPEOUT is a general purpose tape dump program which is described in detail in Reference 6. Tapeout provides the user with a printout of the recording density (200, 556, or 800 bpi), the tape parity (even or odd) and physical record length (fixed length, fixed blocked, or variable length) and also a partial dump (80 characters) of the record. This information is necessary to prepare the job control language (JCL) cards for the DIGISTD and DIGIXBT programs.

The TAPEOUT program listed below is a modification of the program described in Reference 6.

```
//(STANDARD JOB CARD)
//EXEC TAPEOUT,PARM='1,,1,,32760'
//FTO6001  DD SPACE=(CYL,(6,1)),SYSOUT=0
//TAPEIN DD UNIT=2400-1,LABEL=(,BLP),VOL=SER=UCM011
/*
```

This modification prints out the complete tape instead of just 80 characters and also provides the necessary density, parity, and record length parameters. By obtaining a printout of the entire tape, the errors which occurred in the

header during the digitizing procedure are easily identified and located. This is particularly useful during the preparation of the data cards for the DIGISTD, and DIGIXBT programs. For an explanation of the arguments see Reference 6.

APPENDIX D

```
C TITLE          DIGISTD
C
C
C PROGRAMMERS    R.E.GREER,R.E.BLUMBERG,AND J.G.HUGHES EXTENSIVELY MODIFIED AN
C                ORIGINAL PROGRAM,MIZ2, BY R.G.PAQUETTE.
C
C DOCUMENTATION  R.E.GREER
C
C DATE           26 JUNE 1975
C
C PURPOSE        PROGRAM READS,CONVERTS,AND PROCESSES DIGITIZED SALINITY,
C                TEMPERATURE,AND DEPTH DATA FROM A CALMA DIGITIZER 7-TRACK
C                TAPE.  DATA ARE COMPUTED AND STORED EVERY 0.01 INCHES OF DEPTH
C                FOR OUTPUT TO PRINTER,PUNCHED CARD,OR 9-TRACK TAPE.  PROGRAM
C                CONVERTS DEPTH,TEMPERATURE,SALINITY AND COMPUTES SOUND VELOCITY
C                AND SIGMA-T FOR EACH INDIVIDUAL OCEANOGRAPHIC STATION AND
C                PRINTS THE DATA IN A STATION DATA SUMMARY.
C
C SECUENCE       THE PROGRAM PERFORMS ALL FUNCTIONS IN THE FOLLOWING SEQUENCE
C                OF OPERATIONS:
C                   (A) INITIALIZES ALL ARRAYS AND VARIABLES.
C                   (B) COMPUTES TABLE OF SALINTIY AND TEMPERATURE SCALE
C                   COMVERSION FACTORS.
C                   (C) SKIPS XXX NUMBER OF RECORDS IF NSKP VARIABLE SET OTHER
C                   THAN ZERO ON CONTROL DATA CARD.
C                   (D) READS PAIR OF DATA CARDS (LABEL AND DAT) FOR RECORD
C                   BEING PROCESSED.
C                   (E) TERMINATES PROGRAM IF ISTOP=1 OR AT THE END OF
C                   PROCESSING THE NN-TH RECORD.
C                   (F) SKIPS UNREADABLE OR BAD RECORDS IF NRCSKP VARIABLE SET
C                   TO INDIVIDUAL RECORD NUMBER.
C                   (G) READS USEABLE DATA RECORD INTO A-ARRAY.
C                   (H) MOVES BYTES OF A-ARRAY INTO 4-BYTE WORDS OF B-ARRAY TO
C                   ALLOW PROCESSING BY STANDARD FORTRAN.
C                   (I) PROCESSES RAW B-ARRAY.
C                      (1) IF HEADER RECORD, PROGRAM DECODES HEADER LABEL AND
C                      COMPARES TO LABEL SUPPLIED BY DATA CARD.
C                      (2) IF TRACER RECORD, PROGRAM ADDS AND STORES CUMULATIVE
C                      SUMS OF X AND Y DISTANCE TRAVEL.
C                   (J) INDEXES THE VALUES OF CUMULATIVE DISTANCE BY INCREASING
C                   DEPTH UNITS; INTERPOLATES TO FILL GAPS IN THE FINAL ARRAY
C                   WHICH MAY OCCUR AT THE POINTS OF SCALE CHANGES IN THE
C                   SEGMENTED RECORD.
C                   (K) INSERTS MANUALLY ENTERED SURFACE AND NEAR SURFACE DATA
```

```
C                    VALUES VIA DATA CARD.
C                    (L) INCREMENTS RECORD COUNT AND REPEATS STEPS (D) THRU (K)
C                    UNTIL ALL RECORDS PROCESSED FOR PARTICULAR STATION.
C                    (M) ADJUSTS ALL FINAL DATA ARRAYS TO THE LENGTH OF THE
C                    SHORTEST.
C                    (O) COMPUTES SOUND VELOCITY.
C                    (P) COMPUTES SIGMA-T.
C                    (Q) COMPUTES CONSECUTIVE RECORD SERIALIZATION FOR TAPE
C                    OUTPUT NUMBERING SCHEME.
C                    (R) CONVERTS LETTER DESIGNATOR MONTH/YEAR CODE,AMONC, TO
C                    REAL *8 MONTH/YEAR.
C                    (S) PRINTS OCEANOGRAPHIC DATA STATION SUMMARY.
C                    (T) WRITES ALL STATION DATA ON TAPE IF TAPE=.TRUE..
C                    (U) PUNCHES ALL STATION DATA ON CARDS SUITABLE FOR THESISII
C                    INPUT IF CARDS=.TRUE..
C                    (V) PUNCHES DEPTH,TEMPERATURE,AND SALINITY ON CARDS
C                    SUITABLE FOR INPUT TO HYDROGRAPHIC PROGRAM IF GCARDS=.TRUE..
C                    (W) INITIALIZES ALL ARRAYS AND VARIABLES FOR PROCESSING
C                    NEXT STATION DATA.
C                    (X) REPEATS STEPS (D) THRU (W) UNTIL ALL RECORDS PROCESSED,
C                    ISTOP=1, OR DESIRED RECORD READ.
C
C FEATURES        PROGRAM CONSISTS OF MANY MARKED PROPERTIES WHICH MAKE IT A
C                 HIGHLY VERSATILE PROGRAM FOR PROCESSING OCEANOGRAPHIC DATA
C                 FROM TAPE. SOME OF THESE PROPERTIES ARE LISTED UNDER THE
C                 FOLLOWING SIX GENERAL CATEGORIES:
C                    (A) INPUT
C                       (1) 7-TRACK CALMA DIGITIZER TAPE IN BCD.
C                       (2) TWO DATA CARDS REQUIRED PER TRACE SEGMENT OR HEADER
C                       LABEL RECORD. EXAMPLE:  AN STD TEMPERATURE TRACE
C                       CONSISTING OF FOUR SEGMENTS OR RECORDS WILL REQUIRE FOUR
C                       PAIRS OF DATA CARDS.
C                    (B) SUBROUTINES
C                       (1) TPRD-  AN ASSEMBLER LANGUAGE SUBROUTINE FOR READING
C                       MAGNETIC TAPE WHICH CANNOT BE READ BY STANDARD METHODS.
C                       NOTE: TPRD ALLOWS USER TO SKIP BAD RECORDS WHILE TAPRD
C                       (W.R.CHURCH COMPUTER CENTER SUBROUTINE) DOES NOT.
C                       (2) CHMOVE-  MOVES BYTES OF A-ARRAY INTO FOUR BYTE WORDS
C                       OF B-ARRAY TO ALLOW PROCESSING BY STANDARD FORTRAN.
C                       (3) CONDNS-  CONDENSES,INDEXES,AND CONVERTS THE
C                       CUMULATIVE DISTANCE X AND Y ARRAYS,BY INCREASING DEPTH
C                       UNITS,TO TEMPERATURE AND DEPTH OR SALINITY AND DEPTH.
C                       (4) OUT1-  PRINTS OCEANOGRAPHIC STATION DATA SUMMARY.
C                       (5) SVEL-  COMPUTES SOUND VELOCITY FROM DEPTH,TEMPERATURE
C                       AND SALINITY ACCORDING TO WILSON'S EQUATION.
C                       (6) SIGMT-  COMPUTES SIGMA-T FROM TEMPERATURE AND
C                       SALINITY ACCORDING TO H.O.614 P.91.
C                    (C) AUTOMATIC DATA PROCESSING/HANDLING
```

```
C                      (1) APPLICABLE TO MULTIPLE DEPTH,TEMPERATURE AND SALINITY
C                      SCALES.
C                      (2) HANDLES OPERATOR MISTAKES MADE IN TRACING STD CURVES
C                      ON CALMA DIGITIZER.
C                      (3) SKIPS AN INITIAL NUMBER OF RECORDS SPECIFIED BY NSKP
C                      AND INDIVIDUAL RECORDS(EVEN IF UNREADABLE) SPECIFIED BY
C                      THE ARRAY NRCSKP.
C                      (4) DECODES 7-TRACK TAPE HEADER LABELS AND TRACE RECORDS.
C                      (5) COMPUTES DATA FOR EVERY 0.01 INCHES DEPTH BUT
C                      SELECTABLE FOR GREATER DEPTH INTERVAL.
C                      (6) ENTERS HAND-ENTERED DATA FOR SURFACE AND NEAR-SURFACE
C                      VALUES.
C                      (7) EDITS OUT ANY UNFILLED ARRAY POSITIONS.
C                      (8) COMPUTES CONSECUTIVE RECORD SERIALIZATION FOR TAPE
C                      OUTPUT NUMBERING SCHEME.
C                      (9) COMPUTES SOUND VELOCITY AND SIGMA-T.
C                   (D) DIAGNOSTICS
C                      (1) WRITES FIRST TWENTY-FIVE VALUES OF B-ARRAY FOR
C                      INSPECTION PURPOSES.
C                      (2) WRITES EVERY TWENTIETH VALUE OF STD ARRAYS FOR
C                      DATA INSPECTION PURPOSES.
C                      (3) WRITES PROGRAM STATEMENT NUMBER IN ADDITION TO
C                      MESSAGE WHEN SIGNIFICANT OPERATIONS OCCUR.
C                   (E) TROUBLE-SHOOTING
C                      (1) HANDLES MULTIPLE KEYBOARD AND TRACER SYMBOL ENTRIES.
C                      (2) PROVIDES FOR A MISSED HEADER LABEL OR INCOMPLETE
C                      HEADER LABEL.
C                      (3) HANDLES MISSING INTER-RECORD GAPS.
C                      (4) HANDLES DELETE RECORD BY INCREMENTING RECORD COUNT
C                      AND READING SAME PAIR OF DATA CARDS AGAIN.
C                      (5) COMPARES CARD HEADER LABEL AGAINST TAPE HEADER LABEL
C                      AND ACCEPTS CARD VALUES IF CARD AND TAPE DISAGREE.
C                   (F) OUTPUT
C                      (1) PRINTER-  TWO PRINTING VARIABLES,PRT1 AND PRT2.
C                         (A) OCEANOGRAPHIC DATA STATION SUMMARIES.
C                         (B) PRT2, PROVISION ONLY.
C                      (2) CARD-  TWO CARD PUNCHING ROUTINES,CARDS AND GCARDS.
C                         (A) PUNCHED DATA CARDS SUITABLE FOR USE WITH THESISII.
C                         (B) PUNCHED DATA CARDS FOR INPUT TO HYDROGRAPHIC
C                         PROGRAM.
C                      (3) TAPE-  9-TRACK TAPE
C                      (4) PLOTTING-  PROVISIONS FOR PLOTTING ROUTINES ACTUATED
C                      BY PLT1 AND PLT2 ARE NOT PRESENTLY PROGRAMMED.
C
C ARGUMENTS         PROGRAM CONSISTS OF MANY TERMS,ARRAYS AND VARIABLES.  THE
C                   FOLLOWING IS A BRIEF DESCRIPTION OF THE IMPORTANT ARGUMENTS
C                   LISTED ALPHABETICALLY UNDER TWO GENERAL CATEGORIES.
C                      (A) ARRAYS
```

```
C           (1) D,T,S,D2,T2,S2  = DEPH,TEMPERATURE AND SALINITY
C           (2) DH,TH,SH        = HAND-ENTERED SURFACE AND NEAR
C                               SURFACE DATA VALUES.
C           (3) X,Y             = CUMULATIVE SUMS OF DISTANCE AND
C                               DEPTH TRAVEL.
C           (4) NRCSKP          = NUMBER OF INDIVIDUAL RECORD SKIPPED
C           (5) DCON            = DEPTH CONVERSION FACTOR.
C           (6) CORRS,CORRT     = ADDITIVE CORRECTIONS TO SALINITY
C                               AND TEMPERATURE ASSOCIATED WITH STD
C                               SCALE CHANGES.
C           (7) IREC            = CONSECUTIVE SERIAL RECORD NUMBER.
C           (8) AMONCA          = MONTH/YEAR CODE LETTER.
C           (9) EVENT           = MONTH AND YEAR.
C        (B) TERMS
C           (1) CARDS           = VARIABLE PERMITS PUNCHING CARDS.
C           (2) CONTRL          = NAMELIST VARIABLE USED FOR
C                               INFREQUENTLY CHANGED VARIABLES.
C           (3) CORD            = DEPTH CORRECTION TERM.
C           (4) DAT             = NAMELIST VARIABLE USED FOR
C                               FREQUENTLY CHANGED VARIABLES.
C           (5) DLTREC          = DELETE RECORD
C           (6) FLAG            = INDICATES START OF DATA TRACE.
C           (7) GCARDS          = VARIABLE PERMITS PUNCHING CARDS FOR
C                               HYDROGRAPHIC PROGRAM INPUT.
C           (8) GCRD            = NUMBER OF HYDROGRAPHIC CARDS TO BE
C                               PUNCHED.
C           (9) ICODE           = VARIABLE USED TO IDENTIFY EITHER
C                               TEMPERATURE OR SALINITY TRACE RECORD.
C           (10) ICSQZ          = VARIABLE USED TO COMPRESS NUMBER
C                               OF DATA VALUES OUTPUT TO CARDS
C                               PUNCHING ROUTINE.
C           (11) IGSQZ          = VARIABLE USED TO COMPRESS NUMBER
C                               OF DATA VALUES OUTPUT TO GCARDS
C                               PUNCHING ROUTINE.
C           (12) ISQZ           = VARIABLE USED TO COMPRESS NUMBER
C                               OF DATA VALUES OUTPUT TO PRINTER.
C           (13) IDEPTH         = VARIABLE USED TO IDENTIFY HEADER
C                               LABEL CR TRACE RECORD.
C           (14) ISCL           = THE SCALE NUMBER ON THE STD
C                               SALINITY SCALE DIAL.
C           (15) ITSCL          = THE SCALE NUMBER ON THE STD
C                               TEMPERATURE SCALE DIAL.
C           (16) IDSCL          = THE SCALE NUMBER ON THE STD DEPTH
C                               SCALE DIAL.
C           (17) ISTA           = VARIABLE IDENTIFIES STATION NUMBER.
C           (18) IP             = WHEN SET EQUAL TO 1 ON &DAT, IP IS
C                               A PRINT COMMAND TO CAUSE DATA TO BE
C                               OUTPUT AND VARIABLES INITIALIZED FOR
```

```
C                                  THE NEXT STATION.
C                 (19) IH          = NUMBER OF HAND-ENTERED SURFACE OR
C                                  NEAR-SURFACE DATA VALUES.
C                 (20) IHDR        = WHEN SET EQUAL TO 1 PERMITS
C                                  ENTERING MISSING OR FAULTY DIGITIZER
C                                  TAPE HEADER INFO VIA DATA CARD.
C                 (21) ISTOP       = TERMINATES PROGRAM IF SET EQUAL TO
C                                  1 ON A FINAL &DAT CARD PRECEDED BY
C                                  A LABEL CARD.
C                 (22) JREC        = VARIABLE USED TO COUNT RECORDS FOR
C                                  RECORD SERIALIZATION PURPOSES.
C                 (23) JSKIP       = WHEN SET EQUAL TO 1 ON THE LABEL
C                                  CARD, CAUSES THE PROGRAM TO ACCEPT
C                                  DATA ON AN &CONTRL CARD.
C                 (24) KEY         = THE KEYBOARD SYMBOL ON THE
C                                  DIGITIZER TAPE.
C                 (25) KCRD        = NUMBER OF DATA POINTS TO BE PUNCHED
C                                  BY CARDS PUNCHING ROUTINE.
C                 (26) KDTA        = NUMBER OF RECORDS PROCESSED FOR
C                                  PARTICULAR STATION.
C                 (27) LABEL       = HEADER TYPE DATA CARD WHICH
C                                  IDENTIFIES STATION NUMBER AND TYPE
C                                  TRACE, TEMPERATURE OR SALINITY.
C                 (28) NCRDS       = NUMBER OF CARDS PUNCHED BY CARDS
C                                  PUNCHING ROUTINE.
C                 (29) NE          = THE INDEX AT THE LAST USEFUL ARRAY
C                                  POSITION OF THE X(DEPTH) ARRAY.
C                 (30) NOIRG       = VARIABLE USED TO INDICATE MISSING
C                                  END OF RECORD GAP ON TAPE.
C                 (31) NSKP        = NUMBER OF INITIAL RECORDS ON TAPE
C                                  SKIPPED.
C                 (32) SCON        = SALINITY SCALE CONSTANT.
C                 (33) SCOR        = CORRECTION FACTOR ADDED TO SALINITY
C                                  DATA VALUES.
C                 (34) TCON        = TEMPERATURE SCALE CONSTANT.
C                 (35) TCOR        = CORRECTION FACTOR ADDED TO
C                                  TEMPERATURE DATA VALUES.
C                 (36) WMONTH      = MONTH AND YEAR
C
C
C DATA DECK    THE FOLLOWING IS A SAMPLE DATA DECK REQUIRED BY THIS
C              PROGRAM. SAMPLE BELOW SHOWS DATA CARDS REQUIRED FOR TWO
C              STATIONS, 3070 AND 3080. ALSO SHOWN IS 'STATION END' CARD
C              WTIH ISTOP SET EQUAL TO ONE.
C
 &CONTRL NN=400,TAPE=F,CARDS=F,GCARDS=F,ISQZ=01,NSKP=90,NRCSKP=103,104,105,
 106,107,108,109,110,111,112,113,114,115,116,117,118,119,120,121,122,123,
 124,125,126,175,176,177,178,179,180,181,182,183,184,185,186,ICSQZ=8,
```

```
IGSQZ=8,TCOR=-0.08,SCOR=0.04,&END
    UCM004    INCLUDES STATIONS  3070 THRU 302R MINUS 3080,3090 AND 3140.
STATION 3070 TEMPERATURE HEADER                                              0
&DAT ISTA=307,AMONC='0',IDEPTH=99,IDSCL=1,ICODE=0,ITSCL=4,ISCL=3,IP=0,
DH=0.0,TH=11.24,SH=33.40,IH=1,&END
STATION 3070 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATICN 3070 TEMPERATURE HEADER                                              0
&DAT IDEPTH=99,ITSCL=3&END
STATICN 3070 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATICN 3070 TEMPERATURE HEADER                                              0
&DAT IDEPTH=99,IDSCL=2&END
STATICN 3070 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATICN 3070 TEMPERATURE HEADER                                              0
&DAT IDEPTH=99,ITSCL=2&END
STATICN 307U TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3070 SALINITY HEADER                                                 0
&DAT IDSCL=1,IDEPTH=99,ICODE=1,ITSCL=4,&END
STATICN 3070 SALINITY TRACE                                                  0
&DAT  IDEPTH=00&END
STATION 3070 SALINITY HEADER                                                 0
&DAT IDSCL=2,IDEPTH=99,IP=1,&END
STATICN 3070 SALINITY TRACE                                                  0
&DAT  IDEPTH=00&END
STATICN 3080 TEMPERATURE HEADER                                              0
&DAT ISTA=308,AMONC='0',IDEPTH=99,IDSCL=1,ICODE=0,ITSCL=4,ISCL=3,IP=0,&END
STATION 3080 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3080 TEMPERATURE HEADER                                              0
&DAT IDEPTH=99,ITSCL=3,&END
STATICN 3080 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3080 TEMPERATURE HEADER                                              0
&DAT IDEPTH=99,IDSCL=2&END
STATICN 3080 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATION 3080 TEMPERATURE HEADER                                              0
&DAT IDEPTH=99,ITSCL=2&END
STATICN 3080 TEMPERATURE TRACE
&DAT  IDEPTH=00&END
STATICN 3080 SALINITY HEADER                                                 0
&DAT IDSCL=1,IDEPTH=99,ICODE=1,ITSCL=4,&END
STATICN 3080 SALINITY TRACE                                                  0
&DAT  IDEPTH=00&END
STATICN 3080 SALINITY HEADER                                                 0
```

```
 &DAT IDSCL=2,IDEPTH=99,IP=1,&END
 STATION 3080 SALINITY TRACE                                                  0
 &DAT  IDEPTH=00&END
 STATION END                                                                  1
C (END OF FILE)
C
C
C DECK SET-UP     THE FOLLOWING IS AN EXAMPLE OF JOB CONTROL LANGUAGE
C                 AND DECK SET-UP REQUIRED TO USE DIGISTD. THIS
C                 PARTICULAR DECK SET-UP WAS USED TO WRITE FILE 6 ON
C                 9-TRACK TAPE, NPS-527. THE 9-TRACK TAPE WAS WRITTEN AT
C                 800 BPI WITH A LRECL OF 40 AND BLKSIZE OF 32,520.
C                 HINDSIGHT INDICATES THAT IT IS DESIRABLE TO WRITE
C                 THE TAPE AT A BLKSIZE OF 8000 VICE 32,520 SINCE IT IS
C                 EXTREMELY ADVANTAGEOUS TO KEEP FOLLOW ON TAPE
C                 PROCESSING PROGRAMS SMALL (IE LESS THAN 100K).
C
C
C
//GUCMSTD6 JOB (2006,0823,0S42),' RE GREER SMC 1413',TIME=10,
//     TYPRUN=HOLD,
//     MSGCLASS=0
// EXEC FORTCLG,REGION.FORT=150K,REGION.GO=350K,DEST=0
//FORT.SYSIN DD *
C       ( MAIN SOURCE DECK AND SUBROUTINES)
//GO.FT06F001  DD SPACE=(CYL,(40,03)),SYSOUT=0
//GO.FTC7F001  DD DUMMY
//GO.FTC8F001  DD UNIT=3400-4,VOL=SER=NPS527,LABEL=(06,SL,,OUT),
//   DISP=(NEW,KEEP),DCB=(DEN=2,RECFM=FB,LRECL=40,BLKSIZE=32520),
//   DSN=S2006.UCM7374
//GO.METTAP DD UNIT=2400-1,VOL=SER=UCM004,DISP=OLD,LABEL=(,NL),
//       DCB=(DEN=1,TRTCH=ET)
//GO.SYSIN DD *
C       (DATA DECK)
C (END OF FILE)
```

```
C
C MAIN PROGRAM
C
C
C      **********************  D I G I S T D  **************************
C
C
      DIMENSION X(4001), Y(4001), LABEL(19), SH(50), TH(50), DH(50),
     1INTA(10), INSA(10), NRCSKP(99), DCON(3), CORRS(7), CORRT(7),
     2IREC(1801), AMONCA(13), EVENT(13)
      INTEGER B(8001),ZER,DOL,STAR,ONE,FLAG,DLTREC,ZERO,DLR,BLANK,GCRD,
     1A(2001),TWO,THREE,FOUR,FIVE,SIX,SEVEN,EIGHT,TEN,ELEVEN,AMONT,FG
      LOGICAL PRT1,PRT2,PLT1,PLT2,TAPE,ENDFL,CARDS,SKIP,GCARDS
      COMMON /C1/ T(1801),S(1801),D(1801),SV(1801),SIG(1801),
     1S1(1801),T1(1801),D2(1801),S2(1801),T2(1801)
      REAL *8EVENT,WMONTH
      DATA AMONCA/'H','I','C','K','L','O','P','Q','R','U','V','W','Z'/
      DATA EVENT/'AUG 1973','SEP 1973','OCT 1973','NOV 1973','DEC 1973',
     1'JAN 1974','FEB 1974','MAR 1974','APR 1974','MAY 1974','JUN 1974',
     2'JUL 1974','AUG 1974'/
C     ****************************************************************
C
      NAMELIST /CONTRL/ NN,PRT1,PRT2,PLT1,PLT2,TAPE,ENDFL,CARDS,ISTOP,IP
     1,IH,NRCSKP,NSKP,JSKIP,JREC,ISQZ,ICSQZ,IGSQZ,GCARDS,TCOR,SCOR
     2/DAT/SH,TH,DH,IH,ICODE,ISCL,ITSCL,IDSCL,IP,IDEPTH,ISQZ,IGSQZ,ICSQZ
     3,SCOR,TCOR,IHDR,NOIRG,ISTA,TCON,SCON,DCON,CORD,SKIP,CORRS,CORRT,
     4AMONC,TAPE,CARDS,GCARDS
C
C      *****************************************************************
C      ************************* DEFINE SYMBOLS ************************
C
C      DEFINE SYMBOLS,NOTING THAT THE LEFT THREE HEX BYTES IN EACH
C      ELEMENT OF B END UP FILLED WITH BLANKS
      DATA DOL/'$$$$'/,STAR/Z4040405C/,KEY/Z4040405F/,ONE/Z404040F1/,
     1FLAG/Z40404050/,DLTREC/Z40404060/,MINUS/Z40404061/,
     2 DLR/Z4040405B/,BLANK/'    '/,ZER/Z404040F0/,TWO/Z404040F2/,
     3THREE/Z404040F3/,FOUR/Z404040F4/,FIVE/Z404040F5/,
     4MTWO/Z404040E2/,MTHREE/Z404040E3/,MFOUR/Z404040E4/,MFIVE/Z404040E5
     5/,SIX/Z404040F6/,SEVEN/Z404040F7/,EIGHT/Z404040F8/,NINE/Z404040F9
     6/,TEN/Z404040F0/,ELEVEN/Z4040407B/
C
C      *****************************************************************
C      ************************ DEFINE CONSTANTS ***********************
C
C      THE FOLLOWING CONVERSION FACTORS ARE IN HUNDREDTHS CF INCHES PER
C      UNIT OF S OR T.  THEY MAY BE OVERRIDDEN BY THE DATA CARDS.
      DCON(1) = 3.153
      DCON(2) = 1.261
```

```
      DCON(3) = 0.631
      TCON = 189.680
      SCON = 474.200
C
C      *****************************************************************
C      *************** INITIALIZE ALL TERMS AND VARIABLES **************
C
      DATA CARDS/.FALSE./,CORD/0.0/,ENDFL/.FALSE./,FG/0/,GCARDS/.FALSE./
     1,ICODE/0/,ICSQZ/1/,IGSQZ/1/,IH/0/,IHDR/0/,IP/0/,IPS/8000/,ISCL/0/,
     2IDEPTH/1/,IDSCL/0/,ISTA/999/,ITSCL/0/,
     3ISQZ/1/,ISTOP/0/,JJJ/0/,JJJJ/0/,JREC/0/,JSAV/0/,KBARF/0/,KSCARF/0/
     4,KDTAF/1/,KDTA/1/,KDT1/1/,KDTH1/1/,KDTH2/1/,KS/1/,KS1/1/,
     5KS2/1/,KT/1/,KT1/1/,KT2/1/,NE/0/,NOIRG/0/,NSKP/0/,PLT1/.FALSE./,
     6PLT2/.FALSE./,PRT1/.TRUE./,PRT2/.FALSE./,SCOR/0.0/,SKIP/.FALSE./,
     7TAPE/.FALSE./,TCOR/0.0/
C
C      *****************************************************************
C      ********************* INITIALIZE ALL ARRAYS *********************
C
C      GIVE THE ARRAYS INITIAL VALUES
C
C
      DO 20 J=1,50
      SH(J) = 0.0
      TH(J) =-5.0
      DH(J) = 0.0
   20 CONTINUE
C
C
C
C
      DO 30 J=1,1801
      D(J) = 0.0
      T(J) =-5.0
      S(J) = 0.0
      D2(J) = 0.0
      T2(J) =-5.0
      S2(J) = 0.0
      T1(J) =-5.0
      S1(J) = 0.0
      IREC(J) = 0
   30 CONTINUE
C
C
C
C
      DO 40 J=1,99
      NRCSKP(J) = 0
```

```
   40 CONTINUE
C
C
C
C
      DO 50 J=1,7,1
      CORRS(J) = 0.0
      CORRT(J) = 0.0
   50 CONTINUE
C
C
C      PROVIDE INITIAL INDICES FOR 10 SALINITY SEGMENTS (INSA) AND 10
C      TEMPERATURE SEGMENTS (INTA).
      INSA(1) = 1
      INSA(2) = 1
      INTA(1) = 1
      INTA(2) = 1
C
      DO 60 J=3,10
      INSA(J) = 980
      INTA(J) = 980
   60 CONTINUE
C
C      COMPUTE A TABLE OF CONVERSION FACTORS FOR SALINITY AND
C      TEMPERATURE. CORRS AND CORRT REPRESENT THE S OR T VALUE AT THE
C      LEFT HAND SIDE OF THE STD TRACE. THE VALUE (J) TO BE USED WILL
C      COME FROM ISCL AND ITSCL. HYTECH STD MODEL 9006 STANDARD
C      TEMPERATURE AND SALINITY SCALES 1 THRU 7 ARE PROVIDED FOR IN
C      THIS PROGRAM IN ADDITION TO DEPTH SCALES 1,2, AND 3. FOR
C      CONVENIENCE THE SCALES FOR TEMPERATURE, SALINITY, AND DEPTH ARE
C      DEFINED HERE.
C     TEMPERATURE SCALES:
C        ITSCL 1= -2 TO 3  (DEG CELSIUS)
C        ITSCL 2=  2 TO 7  (DEG CELSIUS)
C        ITSCL 3=  6 TO 11 (DEG CELSIUS)
C        ITSCL 4= 10 TO 15 (DEG CELSIUS)
C        ITSCL 5= 14 TO 19 (DEG CELSIUS)
C        ITSCL 6= 18 TO 23 (DEG CELSIUS)
C        ITSCL 7= 22 TO 27 (DEG CELSIUS)
C     SALINITY SCALES:
C        ISCL  1= 30.0 TO 32.0  (PPT)
C        ISCL  2= 31.5 TO 33.5  (PPT)
C        ISCL  3= 33.0 TO 35.0  (PPT)
C        ISCL  4= 34.5 TO 36.5  (PPT)
C        ISCL  5= 36.0 TO 38.0  (PPT)
C        ISCL  6= 37.5 TO 39.5  (PPT)
C        ISCL  7= 30.0 TO 40.0  (PPT)
C     DEPTH SCALES:
```

```
C           DCON(1)=  0.0 TO 300.0  (METERS)
C           DCON(2)=  0.0 TO 750.0  (METERS)
C           DCON(3)=  0.0 TO 1500.0 (METERS)
C
      CORRT(7) = 22.0
      CORRS(7) = 30.0
C
C
      DO 70 J=1,6,1
      FJ = J
      CORRT(J) = -2.0+(FJ-1.0)*4.0
      CORRS(J) = 30.0+(FJ-1.0)*1.5
   70 CONTINUE
C
C
C
C      *****************************************************************
C      ***** BEGIN PROCESSING; READ INITIAL DATA FROM TWO CARDS ********
C      PROGRAM PROVIDES FOR READING NSKP RECORDS WITHOUT PROCESSING.
C      NSKP, AS WELL THE 99 VALUES OF NRCSKP MUST BE ON THE FIRST
C      CONTRL CARD. A SINGLE CONTRL CARD IS READ HERE TO SET NSKP AND
C      NRCSKP. THERE ALSO MAY BE AN INFORMATIVE LABEL EXPLAINING HOW
C      MANY AND WHICH RECORDS SKIPPED.
      READ (5,CONTRL)
      READ (5,170) LABEL
      WRITE (6,180) LABEL
C
C      IF TAPE=.TRUE., TAPE MUST BE REWOUND AND APPROPRIATE JCL MUST
C      BE PROVIDED TO DEFINE IT. SEE JCL FOR EXAMPLE IN PRECEDING
C      PROGRAM DOCUMENTATION SECTION.
      IF (TAPE) REWIND 8
      IF (NSKP.EQ.0) GO TO 140
C
C      *****************************************************************
C      ************************* START SKIP LOOP ***********************
C
C
      DO 80 IS=1,NSKP
      IIS = IS
C
C      THE VARIABLE,IPS, IS SET NEGATIVE DURING THE RECORD SKIP PROCESS.
C      THIS AVOIDS TPRD STOPPING ON UNREADABLE OR BAD RECORDS. NO DATA
C      CARDS ARE REQUIRED FOR INITIALLY SKIPPED RECORDS.
C      IMPORTANT NOTE:  INITIALLY SKIPPED RECORDS (NSKP) DIFFER FROM
C      INDIVIDUALLY SKIPPED RECORDS (NRCSKP) IN THAT NRCSKP REQUIRES
C      DATA CARDS AND PERMITS 99 INDIVIDUAL RECORDS TO BE SKIPPED WHILE
C      NSKP DOES NOT REQUIRE DATA CARDS AND PERMITS MULTIPLE RECORDS TO
C      BE SKIPPED. (IE. NSKP=40, THE FIRST 40 RECORDS ON THE TAPE BEING
```

```
C       READ WILL BE SKIPPED; WHEREAS NRCSKP=22,23,24,50 PERMITS RECORD
C       NUMBERS 22,23,24,50 TO BE SKIPPED INDIVIDUALLY.)
C
      IPS = -8000
   80 CALL TPRD (A,IPS,&100,&120)
C
C
C
C       *****************************************************************
C       **************** RESET IPS FOR NORMAL TAPE PROCESSING ***********
      IPS = 8000
      WRITE (6,90) IIS
   90 FORMAT (/5X,I5,' RECORDS SKIPPED'/)
      GO TO 140
C
C       IF END OR  ERROR MESSAGES OCCUR DURING SKIP ROUTINE, PROGRAM
C       STOPS.
  100 WRITE (6,110) IIS
  110 FORMAT (/5X,'FOUND END OF FILE ON RECORD',I4,'DURING SKIP PROCESS'
     1 /)
      GO TO 1580
  120 WRITE (6,130) IIS,A(1),A(2),A(3),A(4)
  130 FORMAT (/5X,'READ ERROR ON RECORD',I5,'ERROR STATISTICS ARE: ',4Z8
     1)
      GO TO 1580
C       *****************************************************************
C       ************************* END SKIP LOOP *************************
C
C       REDEFINE LOOP INDEX TO START AT ONE.
  140 NNN = NN-NSKP
C
C       *****************************************************************
C       *************** START MAIN LOOP FOR EACH RECORD *****************
      IT = 1
  150 IF (IT.GT.NNN) GO TO 1580
      IPS = 8000
      NREC = IT+NSKP
      WRITE (6,160) NREC
  160 FORMAT (/5X,'LABEL  150; START MAIN LOOP.  RECORD NO. ',I3/)
C
C       PROGRAM PERMITS TREATMENT OF A KNOWN NUMBER OF RECORDS,NN, OR
C       STOPPING WHEN ISTOP=1 ON STATION LABEL CARD. THE LABEL CARD HAS
C       TWO DIGITS FOR CONTROL. THE 77-TH COLUMN IS JSKIP; IF JSKIP=0,
C       ONLY TWO CARDS ARE READ. THE 78-TH COLUMN IS ISTOP; IF ISTOP=1,
C       THE PROGRAM STOPS. NORMAL TERMINATION OF THE PROGRAM MAY BE
C       ACCOMPLISHED IN TWO DISTINCT WAYS. EITHER SET NN TO DESIRED
C       RECORD TO STOP OR PLACE A 'STATION END' LABEL CARD AT END OF DATA
C       DECK WITH A ONE IN COLUMN 78. THE 79-TH COLUMN IS AMONC; AMONC IS
```

```
C       AN ALPHABETIC LETTER CODE FOR MONTH AND YEAR. THIS CODE IS
C       CONVERTED TO LITERAL MONTH AND YEAR LATER ON IN PROGRAM.
C
      READ (5,170) LABEL,JSKIP,ISTOP,AMONC
  170 FORMAT (19A4,2I1,A1)
      IF (ISTOP.GT.0) GO TO 1580
      READ (5,DAT)
      WRITE (6,180) LABEL
      WRITE (6,DAT)
C       NORMALLY TWO CARDS, LABEL AND DAT, ARE READ PER RECORD.
C       LESS FREQUENTLY CHANGED VARIABLES ARE ON CONTRL DATA CARD.
      JJJJ = 0
      NCIRG = 0
      IF (JSKIP.EQ.0) GO TO 190
      READ (5,CONTRL)
      WRITE (6,CONTRL)
  180 FORMAT (/5X,19A4/)
C
C
C       PROVISION IS MADE HERE FOR A MISSED HEADER LABEL ON TAPE (AN
C       OPERATOR ERROR). IF IHDR=1,AND ALL INFORMATION REQUIRED IS PLACED
C       ON PARTICULAR &DAT CARD, THE PROGRAM BRANCHES OFF TO  610 AND
C       WRITES STATION INFORMATION AND MESSAGE THAT HEADER IS MISSING,
C       AND FINALLY RETURNS TO 150 TO START NORMAL PROCESSING OF TRACE
C       RECORD DATA. NOTE, RECORD COUNT IS NOT INCREMENTED IN THIS LOOP.
C
  190 IF (IHDR.EQ.1) GO TO 610
  200 CONTINUE
C
C       NOTE: IN EARLIER VERSIONS OF THIS PROGRAM, THERE WAS AN
C       INTERPOLATION ROUTINE HERE FOR HAND-ENTERED DATA BUT IT WAS
C       DELETED SINCE VERY SELDOM ONE HAD CAUSE TO USE IT. HOWEVER, THE
C       CAPABILITY FOR HAND-ENTERED DATA HAS BEEN RETAINED BUT IN A
C       DIFFERENT FORM. SEE COMMENTS FOLLOWING STATEMENT NO. 1130.
C
C-------------------
  210 FORMAT (5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.
     12/5X,11F7.2/5X,11F7.2/5X,3F7.2,60X,I6)
  220 FORMAT (5X,10I5,'  INSA')
  230 FORMAT (5X,10I5,'  INTA')
  240 FORMAT (5X,' KS  , KS1, KS2, KT  , KT1, KT2, JJJ, NE ,KDTH1,KDTH2,KD
     1TA,KDT1,JJJJ'/4X,8I5,2I6,3I5)
C-------------------
C
C-------------------
      IPLACE=245
      WRITE (6,210) (D(J),J=1,1801,20)
      WRITE (6,210) (T(J),J=1,1801,20),IPLACE
```

```
      WRITE (6,210) (S(J),J=1,1801,20),IPLACE
      WRITE (6,220) (INSA(J),J=1,10)
      WRITE (6,230) (INTA(J),J=1,10)
      WRITE (6,240) KS,KS1,KS2,KT,KT1,KT2,JJJ,NE,KDTH1,KDTH2,KDTA,KDT1,J
     1JJJ
C-------------------
C
C
C       FILL THE A ARRAY WITH DOLLARS
C
C
      DO 250 I=1,2001
C       THE 2001 ASSURES THAT THE LAST WORD OF A WILL CONTAIN DOLLARS
C       SINCE 2000 WORDS OR 8000 BYTES OF DATA ARE READ IN.
      A(I) = DOL
  250 CONTINUE
C
C
C       FILL B WITH BLANKS
C
C
      DO 260 I=1,8000
      B(I) = BLANK
  260 CONTINUE
C
C       PROGRAM EXAMINES LIST OF INDIVIDUAL BAD RECORDS,NRCSKP,AND
C       SKIPS THEM. IF NRCSKP(1)=0, THE SKIP ROUTINE IS BY-PASSED.
C       CAUTION:  DO NOT REMOVE PAIRS OF DATA CARDS FOR INDIVIDUALLY
C       SKIPPED CARDS.
C
C       IN USING THE CALMA DIGITIZER, SPURIOUS BLANK RECORDS OCCURRED
C       THROUGHOUT THE TAPE ON NUMEROUS OCCASSIONS. MANY OF THESE
C       OCCURRENCES WERE LATER TRACED TO EQUIPMENT MALFUNCTION.
C       HOWEVER, IF A BLANK RECORD OCCURS DURING A HEADER LABEL RECORD
C       NOTHING IS LOST SINCE HEADER INFO MAY BE INSERTED BY CARD AND
C       SETTING IHDR=1. ON THE OTHER HAND, IF A BLANK RECORD OCCURS
C       DURING A TRACE RECORD THE COMPLETE STATION IS LOST. FROM
C       EXPERIENCE, A BLANK RECORD WILL GENERALLY HAVE TWO CHARACTERS.
C       AFTER THE FIRST PROGRAM RUN AND A DETERMINATION OF BLANK OR
C       BAD RECORDS HAS BEEN MADE, THESE MAY BE SKIPPED INDIVIDUALLY VIA
C       NRCSKP ROUTINE.
      IF (NRCSKP(1).EQ.0) GO TO 320
C
C
C       ****************************************************************
C       *************** START INDIVIDUAL RECORD SKIP LOOP ***************
C
C
```

```
      DO 270 LB=1,99
      NRC = NRCSKP(LB)-NSKP
      IF (NRC.EQ.IT) GO TO 280
  270 CONTINUE
C
      GO TO 300
  280 IPS = -8000
  290 FORMAT (//5X,'LABEL 290. RECORD NO.',I5,' SKIPPED VIA NRCSKP SKIP
     1 ROUTINE.'//)
      WRITE (6,290) IT
C     CHANGING IPS TO NEGATIVE CAUSES TPRD  TO SKIP A RECORD
  300 IF (ICODE.EQ.0) GO TO 320
      WRITE (6,310) IDEPTH,ICODE,ISCL
  310 FORMAT (5X,'SALINITY VERSUS DEPTH'/
     1 5X,'STD RECORD STARTS AT ',I3,' METERS'/
     2 5X,'CODE =  ',I2/
     3 5X,'SCALE = ',I2/)
C
C      *****************************************************************
C      ********************** READ TAPE ********************************
  320 CALL TPRD (A,IPS,&350,&330)
C
C      IPS IS THE MAXIMUM NUMBER OF BYTES OF DATA WHICH WILL BE READ
C      FROM ONE RECORD OF DIGITIZER TAPE BY TPRD. IPS/2 IS THE MAXIMUM
C      TOTAL TRAVEL ALONG THE CURVE MEASURED IN 0.01 INCHES IN THE X
C      AND Y DIRECTION SEPARATELY. 350 IS THE END OF FILE EXIT, AND 330
C      IS THE READ-ERROR EXIT.
      GO TO 360
  330 WRITE (6,340) A(1),A(2),A(3),A(4)
  340 FORMAT (5X,'I10 ERROR STATISTICS TABLE IS ',4Z8)
C
  350 CONTINUE
  360 CONTINUE
C
C      *****************************************************************
C      **************** END INDIVIDUAL RECORD SKIP LOOP ****************
C
C      PROCESS THE LAST RECORD
C      MOVE THE BYTES OF A INTO THE 4-BYTE WORDS OF B USING CHMOVE.
      JJ = 0
      JJJ = 0
C
C
      DO 370 II=1,2000
C
C
      DO 370 I=1,4
      JJ = JJ+1
```

```
      CALL CHMOVE (A(II),I,B(JJ),4)
      IF (B(JJ).EQ.DLR) GO TO 380
C      END OF DATA DETECTED
C      THERE MAY BE A STAR BEFORE THE DOLLAR
  370 CONTINUE
C
C
  380 CONTINUE
      B(8001) = DLR
C
C      *****************************************************************
C      ***************** PREPARE TO PROCESS RAW ARRAY ******************
C
      WRITE (6,390) JJ,(B(J),J=1,25)
  390 FORMAT (/5X,'LABEL 390.  ARRAY B IS FILLED; LOOK FOR MODE CHARACTE
     1R.  THE NUMBER OF ARRAY ELEMENTS PROCESSED INCLUDING STARS AND '/
     2 5X,'DOLLARS, JJ= ',I5,/5X,'FIRST  25 CHARACTERS ARE: ',
     3 10(1X,Z8)/5X,10(1X,Z8)/5X,5(1X,Z8)/)
C
C     ******************************************************************
C
      JJ = 1
      GO TO 430
C
C      *****************************************************************
C      ******************** START MISSING IRG ROUTINE ******************
C
C      THE FOLLOWING ROUTINE READS ANOTHER SET OF CARDS.  THIS IS THE
C      ENTRY FOR THE SITUATIONS IN WHICH THE IRG IS MISSED.
  400 READ (5,170) LABEL,JSKIP,ISTOP,AMONC
      IF (ISTOP.GT.0) GO TO 1580
      IF (JSKIP.EQ.0) GO TO 410
      READ (5,DAT)
      WRITE (6,180) LABEL
      WRITE (6,DAT)
      READ (5,CONTRL)
      WRITE (6,CONTRL)
C-----------------
  410 IPLACE=410
      WRITE (6,210) (D(J),J=1,1801,20)
      WRITE (6,210) (T(J),J=1,1801,20),IPLACE
      WRITE (6,210) (S(J),J=1,1801,20),IPLACE
      WRITE (6,220) (INSA(J),J=1,10)
      WRITE (6,230) (INTA(J),J=1,10)
      WRITE (6,240) KS,KS1,KS2,KT,KT1,KT2,JJJ,NE,KDTH1,KDTH2,KDTA,KDT1,J
     1JJJ
      WRITE (6,420) NOIRG,JJJJ
  420 FORMAT (/5X,'LABEL 410.  PROCESSING SECOND HALF.  NOIRG=',I3,
```

```
     1 'JJJJ=',I5/)
C-------------------
      NOIRG = 0
      JJ = JJJJ
C
C      ******************************************************************
C      *******************END MISSING IRG ROUTINE ***********************
C
C      INITIALIZE ADDERS,ETC.
  430 SUMD = 0.
      SUMD = 0.
      SUMT = 0.
      N = 0
      KL = 0
      KK = 0
C
C      ******************************************************************
C      ************************ MODE SYMBOL CHECK ***********************
C
  440 IF (B(JJ).EQ.KEY) GO TO 490
C      THE FIRST ELEVEN VALUES OF THE B-ARRAY ARE CHECKED FOR A
C      KEYBOARD SYMBOL SINCE IT IS POSSIBLE TO HAVE GARBAGE VALUES AHEAD
C      OF THE KEYBOARD SYMBOL. IF ALL ELEVEN VALUES ARE NOT KEYS
C      THEN JJ IS RESET TO 1 AND THE RECORD IS PROCESSED AS A TRACE.
C      HOWEVER, IF ONE OF THE ELEVEN VALUES ARE A KEY, PROGRAM BRANCHES
C      TO 490, AND PROCESSES AS A HEADER. AT FIRST GLANCE, THIS
C      PROCEDURE APPEARS TO ASSUME THAT IT IS IMPOSSIBLE TO HAVE A
C      KEY SYMBOL APPEAR IN THE FIRST ELEVEN CHARACTERS OF A TRACE
C      RECORD. THIS IS NOT A BAD ASSUMPTION SINCE THE OPERATOR HAS TO
C      GO OUT OF HIS WAY TO INITIATE KEYBOARD MODE DURING TRACE MODE.
C      HOWEVER, LEAVING NOTHING TO CHANCE THE PROGRAM WILL KEEP
C      CHECKING FOR KEY OR TRACER UNTIL OPERATOR MAKES UP HIS MIND
C      WHICH MODE IS CORRECT. IF NO TRACER SYMBOLS APPEAR AFTER PROGRAM
C      FINDS A KEY, THEN RECORD WILL BE PROCESSED AS A HEADER. ON THE
C      OTHER HAND, IF NO KEY SYMBOLS APPEAR AFTER PROGRAM FINDS A TRACER
C      THEN THE RECORD WILL BE PROCESSED AS A TRACE.
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 490
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 490
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 490
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 490
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 490
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 490
```

```
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 490
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 490
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 490
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 490
      JJ = JJ-10
      IF (KL.EQ.1) GO TO 500
      IF (KL.EQ.2) GO TO 500
C      NO KEYBOARD SYMBOL; MAY HAVE FORGOTTEN IT. TEST THE 5TH AND
C      6TH SYMBOLS (IDEPTH).  IF BOTH ARE NINES CALL IT A KEYBOARD.
      IF (B(5).EQ.NINE.AND.B(6).EQ.NINE) GO TO 450
      GO TO 670
  450 IJJ = JJ+12
      WRITE (6,460) (B(I),I=JJ,IJJ)
  460 FORMAT (/5X,'AT 450, MISSING KEY.  B(1) TO B(13)=',13A1/)
      GO TO 500
C
  470 WRITE (6.480)
  480 FORMAT (5X,'FOUND EIGHT KEYBOARD SYMBOLS IN SEQUENCE.   STOP.')
      GO TO 1570
  490 KL = KL+1
      JJ = JJ+1
C      A CHECK IS MADE HERE FOR MULTIPLE KEYBOARD SYMBOLS. IF NUMBER
C      EXCEEDS EIGHT, PROGRAM TERMINATES. THE NUMBER EIGHT IS ARBITRARY
C      BUT ONE WOULD PROBABLY NOT WANT TO USE A NUMBER GREATER THAN 12
C      (IE. ONE LESS THAN NUMBER OF CHARACTERS IN HEADER). EXPERIENCE
C      INDICATES THAT SELDOM DOES ONE INCUR MORE THAN THREE KEYBOARD
C      SYMBOLS ON A TAPE PER RECORD.
      IF (KL.EQ.8) GO TO 470
      IF (B(JJ).EQ.STAR) GO TO 670
C      TRY AGAIN
      GO TO 440
C
C      ****************************************************************
C      ********************* START KEYBOARD DECODE *********************
C
C      PROCESS KEYBOARD ENTRIES.  CHANGE THE WORDS TO
C      INTEGER FORM BY SUBTRACTING Z404040F0 AND CREATE MULTI-DIGIT
C      INTEGERS
C      SKIP=T PERMITS NAMELIST DATA TO OVERRIDE HEADING DATA.  ALL THE
C      HEADING DATA MUST THEN BE ON THE NAMELIST CARDS.
  500 IF (SKIP) GO TO 610
      ISTAA = 0
      IDEPT = 0
C      DEFINE INDICES FOR DECODING THE LABEL
```

```
      KY1 = JJ
      KY2 = KY1+2
      KY3 = KY1+3
      KY4 = KY1+4
      KY5 = KY1+5
      KY6 = KY1+6
      KY7 = KY1+7
      KY8 = KY1+8
      KY9 = KY1+9
      KY10 = KY1+10
      KY11 = KY1+11
C
C      DLTREC ARE FOUND HERE IN THE HEADER.  IF DLTREC OCCURS , READ IN
C      A NEW RECORD AND USE SAME CARDS.
C
C
      DO 510  J=KY1,KY10
      IF (B(J).EQ.DLTREC) GO TO 520
  510 CONTINUE
C
C
      GO TO 550
  520 WRITE (6,530)
  530 FORMAT (/5X,'DLTREC IN HEADER. REPEAT,USING SAME CARDS.'/)
  540 IT = IT+1
      GO TO 200
  550 KT2 = 10
      KS2 = 10
C      THESE TWO STATEMENTS GIVE MAXIMUM VALUES TO KT2 AND KS2 SO THAT
C      THEY WILL ALWAYS BE DEFINED, EVEN IF  ONLY ONE VARIABLE IS TRACED
C
C      DO THE CONVERSION, COMPARE WITH VALUES READ FROM THE CARDS,ACCEPT
C      THE CARDS.
C
C
      DO 560  J=KY1,KY2
      B(J) = B(J)-ZER
      IB = B(J)
      ISTAA = ISTAA+IB*10**(KY2-J)
  560 CONTINUE
C
      AMCNT = B(KY3)
C
C
      DO 570  J=KY4,KY5
      B(J) = B(J)-ZER
      IB = B(J)
      IDEPT = IDEPT+IB*10**(J-KY4)
```

```
  570 CONTINUE
C
      IDSC = B(KY6)-ZER
      ICOD = B(KY7)-ZER
      ITSCL1 = B(KY8)-ZER
      ISCL1 = B(KY9)-ZER
      IPP = B(KY10)-ZER
C
C       IF THERE IS A DISAGREEMENT, WRITE A MESSAGE.
      IF (ISTAA.NE.ISTA) GO TO 590
      IF (IDEPT.NE.IDEPTH) GO TO 590
      IF (IDSC.NE.IDSCL) GO TO 590
      IF (ICOD.NE.ICODE) GO TO 590
      IF (ITSCL1.NE.ITSCL) GO TO 590
      IF (ISCL1.NE.ISCL) GO TO 590
      IF (IPP.NE.IP) GO TO 590
  580 FORMAT (5X,'LABEL= 580.  CARD INPUTS EQUALLED TAPE HEADER FOR
     1 STATION ',I3,A1/5X,'IDEPTH= ',I3/)
      WRITE (6,580) ISTA,AMONC,IDEPTH
      GO TO 610
  590 WRITE (6,600) ISTA,AMONC,IDEPTH,IDSCL,ICODE,ITSCL,ISCL,IP,ISTAA,AM
     1ONT,IDEPT,IDSC,ICOD,ITSCL1,ISCL1,IPP
  600 FORMAT (/3X'CARD AND TAPE DISAGREE, CARD ON TOP'/3X,'   ISTA  AMON
     1C   IDEPTH  IDSCL  ICODE  ITSCL   ISCL    IP'/3X,I7,A7,6I7/3X,I7
     2 ,A7,6I7/)
C       WRITE THE RESULTS
  610 WRITE (6,620) ISTA,AMONC,IDEPTH
  620 FORMAT (5X,'LABEL 610.  HEADER PROCESSING COMPLETE EXCEPT SEARCH F
     1OR ERRORS ON STATION ',I3,A1/5X,'IDEPTH= ',I3/)
C
C
C       IT IS POSSIBLE THAT NO IRG EXISTS AFTER THE HEADER.IF SO,
C       THE PROGRAM HAS FILLED THE B ARRAY WITH BOTH THE HEADER AND TEMP.
C       OR SALINITY TRACE. ASSUME THERE IS A TRACER SYMBOL IN POSITION
C       12. IF SO, CONTINUE TO PROCESS THE B-ARRAY
      IF (B(KY11).NE.STAR) GO TO 640
      JJJJ = KY11
      WRITE (6,630)
  630 FORMAT (/5X,'NO IRG AFTER HEADER; CONTINUE TO PROCESS B ARRAY.'/)
      GO TO 400
  640 IF (IHDR.EQ.0) GO TO 660
C
C       THIS BRANCH RETURNS TO 150 IF MISSED HEADER AND IHDR SET EQUAL 1.
      WRITE (6,650)
  650 FORMAT (/5X,'HEADER MISSING; INFO INSERTED WITH CARDS.'/)
      IHDR = 0
      GO TO 150
  660 CONTINUE
```

```
      GO TO 1550
C      *****************************************************************
C      ********************** END KEYBOARD DECODE *********************
C
C
C      *****************************************************************
C      ***************** START OF NORMAL TRACE PRCCESSING *************
C
C      THE FOLLOWING PROCEDURE PERMITS THE PRESENCE OF ANY REASONABLE
C      NUMBER OF TRACER SYMBOLS (STAR) INCLUDING NONE.
  670 NE = 0
      NF = 0
      NSTAR = 0
  680 IF (B(JJ).EQ.STAR) GO TO 700
C
C      COUNT STARS AND WRITE MESSAGE
      WRITE (6,690) NSTAR
  690 FORMAT (/5X,'START TRACER MODE; NO. OF TRACER SYMBOLS =',I2/)
C      WHEN THERE ARE NO MORE STARS, START TESTING FOR COUNT SYMBOLS ETC
      GO TO 710
  700 JJ = JJ+1
      NSTAR = NSTAR+1
C      WE CONTINUE TO TEST FOR STARS UNTIL NO MORE APPEAR.
      GO TO 680
C
C      THE NEXT BLOCK OF OPERATIONS TO STATEMENT NO. 950 LOOPS BACK TO
C      710 CONTINUALLY, TESTING EACH CHARACTER FOR IDENTITY AND
C      CONTINUING TO ADD OR SUBTRACT FROM THE CUMULATIVE Y AND X COUNTS
C      UNTIL A DELETE-RECORD SYMBOL OR A STAR OR A DOLLAR INDICATES
C      THE END OF DATA.  THE FLAG IS PLACED AT THE POINT WHERE THE TRACE
C      ENTERS THE CROSS-SECTIONED AREA; PREVIOUS COUNTS RESULT FROM THE
C      TRACER TRAVELLING FROM THE COORDINATE ZERO TO THIS POINT.
  710 IF (B(JJ).EQ.ONE) GO TO 730
      IF (B(JJ),EQ.BLANK) GO TO 740
      IF (B(JJ).EQ.MINUS) GO TO 750
      IF (B(JJ).EQ.FLAG) GO TO 900
C      THE NEXT GROUP OF STATEMENTS ALLOW FOR OCCASIONAL COUNTS GREATER
C      THAN + OR - 1.
      IF (B(JJ).EQ.TWO) GO TO 760
      IF (B(JJ).EQ.THREE) GO TO 770
      IF (B(JJ).EQ.FOUR) GO TO 780
      IF (B(JJ).EQ.FIVE) GO TO 790
      IF (B(JJ).EQ.SIX) GO TO 800
      IF (B(JJ).EQ.SEVEN) GO TO 810
      IF (B(JJ).EQ.EIGHT) GO TO 820
      IF (B(JJ).EQ.NINE) GO TO 830
      IF (B(JJ).EQ.TEN) GO TO 840
      IF (B(JJ).EQ.ELEVEN) GO TO 850
```

```
      IF (B(JJ).EQ.MTWO) GO TO 860
      IF (B(JJ).EQ.MTHREE) GO TO 870
      IF (B(JJ).EQ.MFOUR) GO TO 880
      IF (B(JJ).EQ.MFIVE) GO TO 890
      IF (B(JJ).EQ.DLTREC) GO TO 970
      IF (B(JJ).EQ.KEY) GO TO 440
  720 FORMAT (//5X,'SYMBOL NOT RECOGNIZED = ',Z8//)
      WRITE (6,720) B(JJ)
C      IF SYMBOL IS NOT RECOGNIZED, STATION DATA IS NOT PRINTED IF IP=1.
C      PROGRAM BRANCHES AND RE-INITIALIZES ALL VARIABLES FOR PROCESSING
C      NEXT STATION IF IP=1. OTHERWISE, IT RETURNS TO READ NEXT RECORD.
      IF (IP.EQ.1) GO TO 1510
      GO TO 1570
  730 RX = 1.
      GO TO 910
  740 RX = 0.
      GO TO 910
  750 RX = -1.
      GO TO 910
  760 RX = 2.
      GO TO 910
  770 RX = 3.
      GO TO 910
  780 RX = 4.
      GO TO 910
  790 RX = 5.
      GO TO 910
  800 RX = 6.
      GO TO 910
  810 RX = 7.
      GO TO 910
  820 RX = 8.
      GO TO 910
  830 RX = 9.
      GO TO 910
  840 RX = 10.
      GO TO 910
  850 RX = 11.
      GO TO 910
  860 RX = -2.
      GO TO 910
  870 RX = -3.
      GO TO 910
  880 RX = -4.
      GO TO 910
  890 RX = -5.
      GO TO 910
  900 JJJ = NE
```

```
      JJ = JJ+1
      FG = 1
      GO TO 710
C
C      PROGRAM ADDS AND STORES CUMULATIVE SUMS. ONE UNIT EQUALS 0.01
C      INCH.
  910 N = N+1
      NE = N/2
      NF = NE*2
      IF (NF.EQ.N) GO TO 920
C      THIS FIDDLING AROUND DETERMINES IF THE COUNT IS EVEN OR ODD.
C      START COUNTING IN THE ORDER YXYX.  X AND Y HAVE NORMAL
C      ORIENTATIONS ON THE STRIP CHART. HOWEVER, X AND Y ARE INVERTED
C      WITH RESPECT TO THE CALMA DIGITIZER. SPECIFICALLY, DEPTH
C      INCREASES ALONG THE POSITIVE X-AXIS AND TEMP AND SALINITY ARE
C      INCREASING FUNCTIONS ALONG THE Y-AXIS ON THE CALMA DIGITIZER.
C      WARNING: DIGITIZE TRACES ACCORDING TO ABOVE ORIENTATION OR BE
C      PREPARED TO RE-DIGITIZE TAPE LATER AFTER DISCOVERING GOOF.
C
C      IF ODD
      SUMD = SUMD+RX
C      ODD INDEX IS INCREASED TO KEEP IT SAME AS EVEN.
      NE = NE+1
      Y(NE) = SUMD
      JJ = JJ+1
      GO TO 930
C      IF EVEN
  920 SUMT = SUMT+RX
      X(NE) = SUMT
      JJ = JJ+1
C      IF STAR OR DOLLAR FOUND, END OF DATA HAS BEEN REACHED.
  930 IF (B(JJ).EQ.DLR) GO TO 990
C      *****************************************************************
C      ***************** END OF NORMAL TRACE PROCESSING ****************
C
C
C      *****************************************************************
C      ********************* BEGIN TROUBLE-SHOOTING ********************
C      IF THERE IS NO IRG AT END OF HEADER BUT THERE IS A TRACER SYMBOL,
C      THE PROGRAM SEPARATES THE TWO RECORDS BY FIRST SETTING NOIRG=1
C      AND PROCESSING FIRST PART OF B-ARRAY AND THEN READING A NEW SET
C      OF CARDS TO PROCESS SECOND PART OF B-ARRAY.
      IF (B(JJ).NE.STAR) GO TO 950
      NOIRG = 1
C      SAVE THE INDEX OF THE START OF THE SECOND HALF, JJJJ.
      JJJJ = JJ
      WRITE (6,940)
  940 FORMAT (/5X,'FOUND A STAR AT END OF TRACER ASSUME THERE IS NO IRG.
```

```
     1'/5X,'PROCESS RECORD IN TWO PARTS, READING CARDS FOR BOTH PARTS.'/
     2)
      GO TO 990
  950 IF (B(JJ).NE.KEY) GO TO 710
      JJJJ = JJ
      WRITE (6,960)
  960 FORMAT (/5X,'FOUND A KEYBOARD SYMBOL.  PROCESS NEXT PORTION OF B-A
     1RRAY AFTER READING NEW CARDS.'/)
      NOIRG = 1
      GO TO 990
C
  970 WRITE (6,980) JJ
  980 FORMAT (5X,'FOUND DELETE RECORD SYMBOL AT JJ= ',I5)
C       IF DELETE RECORD FOUND, PROGRAM INCREMENTS RECORD COUNT,IT,
C       AND RESTARTS PROCESSING BUT DOES NOT READ A NEW PAIR OF CARDS.
      GO TO 540
  990 JJ = JJ-1
C
C       *****************************************************************
C       ********** END TRACER AND ASSOCIATED TROUBLE-SHOOTING ***********
C
C       UP TO THIS POINT, PROCESSING IS IDENTICAL FOR S AND T.
C       START CONVERTING T AND D TO SCIENTIFIC UNITS
      WRITE (6,1000) JJJ,NE,Y(NE),X(NE)
 1000 FORMAT (/5X,'LABEL 1000. START CONDENSING UNCONVERTED ARRAY AND CO
     1NVERTING TO SCIENTIFIC UNITS.'/5X,'THE TRACER ENTEREC THE FRAME (F
     2LAG) AT JJJ= ',I5/5X,'THE END OF THE TRACE HAS INDEX NE= ',I5/
     3 5X,'LAST (UNCONVERTED) DEPTH AND TEMP ARE: ',F7.1,2X,F7.1/)
C
C
C       CHECK TO SEE IF FLAG WAS FOUND.
      IF (FG.EQ.1) GO TO 1020
      WRITE (6,1010)
 1010 FORMAT (/5X,'NO FLAG FOUND; PROCESS ANYWAY.'/)
 1020 WRITE (6,1030)
 1030 FORMAT (' ')
      FG = 0
C
C       THE X AND Y ARRAYS ARE FILLED AND THE START AND END OF THIS BATCH
C       OF DATA ARE LABELLED WITH JJJ AND NE.
C       CONVERT THE ARRAYS INDEXED ON 0.01-INCH DEPTH SPACINGS.
C       SUBROUTINE CONDNS SERVES THIS PURPOSE ALTHCUGH IT NO LONGER
C       CONDENSES  A SECOND ARRAY TO SMALLER SIZE, NOR DOES IT PAD THE
C       GAP BETWEEN ARRAYS, BUT WITHIN ONE SEGMENT, IT DOES INTERPOLATE
C       TO FILL ANY BLANK ARRAY POSITIONS.
C
C
C       TC THOSE FAMILIAR WITH EARLIER VERSIONS OF THIS PROGRAM, THE
```

```
C       FCLLOWING CONDENSE ROUTINES WILL NOT EVEN APPEAR REMOTELY
C       SIMILAR. THE EARLIER VERSION HAD TO BE EXTENSIVELY MODIFIED
C       TO PERMIT MULTIPLE DEPTH SCALES. SPECIFICALLY, WHEN USING
C       MULTIPLE DEPTH SCALES ONE'S DEPTH AXIS REFERENCE CHANGES AND
C       CONSEQUENTLY IN CONSTRUCTING THE S AND D OR T AND D ARRAYS
C       THIS ROUTINE WORKS WELL.
      IF (ICODE.EQ.0) GO TO 1080
C   *                                                                 *
C   S*****************************************************************S
C       CONDENSE THE X AND Y ARRAYS INTO S AND D
C   S*****************************************************************S
C   *                                                                 *
      KS = KS+2
      KS1 = KS-1
      KS2 = KS+1
      IF (IDSCL.EQ.1) GO TO 1040
      KDT1 = KSCARF+1
      GO TO 1050
 1040 KDT1 = INSA(KS1)
 1050 CALL CONDNS (X,Y,S1,JJJ,NE,KDT1,KDTH1,KDTH2)
      KDTA = KDTH1+1
      K = KDTH1
      IF (IDSCL.EQ.1) GO TO 1060
      K = KDT1
C
C
 1060 DO 1070 J=KDTH1,KDTH2
      D(K) = (J-1)/DCON(IDSCL)+CORD
      S(K) = S1(J)/SCON+CORRS(ISCL)+SCOR
      K = K+1
      KSCARF = K
 1070 CONTINUE
C
C
      INSA(KS) = KDTH1
      INSA(KS2) = KDTH2
      GO TO 1130
C   *                                                                 *
C   T*****************************************************************T
C       CCNDENSE THE X AND Y ARRAYS INTO T AND D
C   T*****************************************************************T
C   *                                                                 *
 1080 KT = KT+2
      KT1 = KT-1
      KT2 = KT+1
      IF (IDSCL.EQ.1) GO TO 1090
      KDT1 = KBARF+1
      GO TO 1100
```

```
 1090 KDT1 = INTA(KT1)
 1100 CALL CONDNS (X,Y,T1,JJJ,NE,KDT1,KDTH1,KDTH2)
      KDTA = KDTH1+1
      K = KDTH1
      IF (IDSCL.EQ.1) GO TO 1110
      K = KDT1
C
C
 1110 DO 1120 J=KDTH1,KDTH2
      D(K) = (J-1)/DCON(IDSCL)+CORD
      T(K) = T1(J)/TCON+CORRT(ITSCL)+TCOR
      K = K+1
      KBARF = K
 1120 CONTINUE
C
C
      INTA(KT) = KDTH1
      INTA(KT2) = KDTH2
C  *                                                                   *
C  T*******************************************************************T
 1130 CONTINUE
C
C      *****************************************************************
C      *********************** HAND-ENTERED DATA ***********************
C
C      CONVERSION OF X AND Y ARRAYS INTO T AND S ARRAYS IS COMPLETE.
C      AT THIS POINT, SURFACE AND NEAR-SURFACE DATA WILL BE INSERTED.
C      NORMALLY, ONLY SURFACE VALUES NEED TO BE INSERTED DUE TO THE
C      DIGITIZER OPERATOR BEGINNING TO TRACE SLIGHTLY BELOW HIS ZERO
C      DEPTH REFERENCE POINT. SURFACE DATA VALUES ARE INSERTED BY
C      CHECKING THE VALUE OF IH. IF IH=0, DATA IS NOT INSERTED. IF IH=1,
C      SURFACE DEPTH,TEMP, AND SALINITY VALUES ARE INSERTED VIA &DAT
C      DATA CARD FOR PARTICULAR STATION.
C      CAUTION: HAND-ENTERED DATA VALUES SHOULD BE CORRECTED VALUES
C      IF CORRECTIONS,TCOR AND SCOR, ARE APPLICABLE.
C      INFREQUENTLY, DATA VALUES BELOW THE SURFACE MUST BE INSERTED.
C      PROVISION IS MADE FOR NEAR-SURFACE DEPTHS DOWN TO APPROXIMATELY
C      15 METERS. THIS OCCURS DUE TO THE SAME REASON AS ABCVE(IE. A NOT
C      SO METICULOUS OPERATOR BEGAN DIGITIZING BELOW ZERO REFERENCE
C      POINT.). SINCE THIS OCCURS SELDOM, AND INVCLVES A SIGNIFICANT
C      AMOUNT OF LABOR TO MANUALLY READ THE STD TRACE, CORRECT THE
C      VALUES IF NEEDED AND PLACE ON &DAT CARD, THIS OPERATION WILL
C      CNLY BE DONE FOR FINAL OUTPUT TO TAPE,CARD OR PRINTER.
C      CONSEQUENTLY, TO INSERT NEAR-SURFACE DATA ISQZ MUST EQUAL 1,
C      IH MUST BE GREATER THAN OR EQUAL TO 2. DH,TH, AND SH WERE
C      DIMENSIONED AT 50. THIS EQUATES TO APPROXIMATELY 15 METERS.
C      ISQZ=1 WAS CHOSEN AS DETERMINING VALUE DUE ALL ELEMENTS OF D,T,
C      AND S ARRAYS ARE PRINTED OUT VIA OUT1. THIS ELIMINATES
```

```
C       'GUESSWORK' OF WHICH VALUES SHOULD BE INSERTED. IN OTHER WORDS,
C       ALL OF THEM ARE INSERTED.
      IF (IH.EQ.0) GO TO 1150
      S(1) = SH(1)
      T(1) = TH(1)
      IF (IH.LT.2) GO TO 1150
      IF (ISQZ.GT.1) GO TO 1150
C
C
      DO 1140 J=2,IH
      S(J) = SH(J)
      T(J) = TH(J)
      D(J) = DH(J)
 1140 CONTINUE
C
C
 1150 CONTINUE
C *                                                                     *
C------------------
      IPLACE=1155
      WRITE (6,210) (D(J),J=1,1801,20)
      WRITE (6,210) (T(J),J=1,1801,20),IPLACE
      WRITE (6,210) (S(J),J=1,1801,20),IPLACE
      WRITE (6,220) (INSA(J),J=1,10)
      WRITE (6,230) (INTA(J),J=1,10)
      WRITE (6,240) KS,KS1,KS2,KT,KT1,KT2,JJJ,NE,KDTH1,KDTH2,KDTA,KDT1,J
     1JJJ
C------------------
C
      IF (IP.EQ.1) GO TO 1160
      IF (NOIRG.EQ.1) GO TO 400
      GO TO 1570
 1160 IN1 = KBARF
      IN2 = KSCARF
      KDTA = MINO(IN1,IN2)
 1170 FORMAT (5X,'LABEL=1170.',3I7//)
      WRITE (6,1170) IN1,IN2,KDTA
C       *****************************************************************
C       ********** EDITING OF UNWANTED ZERO DATA VALUES *****************
C
C       IN DIGITIZING TEMP AND SALINITY SEGMENTS OF TRACES ONE CAN NOT
C       AVOID GETTING GAPS SOMETIMES BETWEEN TRACE SEGMENTS. WHEN THIS
C       HAPPENS THE OUTPUT PRINTOUT WILL SHOW -5.0 AND 0.0 FOR THE
C       TEMPERATURE AND SALINITY VALUES RESPECTIVELY. THESE VALUES ARE
C       THE PRE-INITIALIZED VALUES OF THE T AND S ARRAYS, AND INDICATE
C       NO ATTEMPT HAS BEEN MADE TO PLACE DATA IN THE PARTICULAR ARRAY
C       POSITION (IE A GAP IN DATA). IT IS DESIRABLE THAT THESE UNWANTED
C       VALUES OR GAPS BE ELIMINATED PRIOR TO WRITING A TAPE OR PUNCHING
```

```
C        A CARD. THUS A CHECK IS MADE TO SEE IF T(J) OR S(J) ARE -5.0 OR
C        0.0 RESPECTIVELY. IF T(J) AND S(J) ARE NOT -5.0 OR 0.0
C        RESPECTIVELY, THE VALUES ALONG WITH DEPTH ARE PLACED INTO D2,T2,
C        AND S2 ARRAYS. IF GAPS DO EXIST, THE VALUES ARE WRITTEN OUT AND
C        COUNTED BUT NOT PUT INTO THE D2,T2,AND S2 ARRAYS.  THIS PROCESS
C        IN EFFECT DISCARDS THE GAPS IN THE DATA. THE D,T, AND S ARRAYS
C        ARE THEN RE-INITIALIZED, AND THE D2,T2,AND S2 ARRAYS ARE PUT BACK
C        INTO THE D,T,AND S ARRAYS. NOTE, THE VALUE OF KDTA WHICH
C        IS EQUAL TO TOTAL NUMBER OF RECORDS IS REDUCED BY NUMBER OF
C        UNWANTED RECORDS BY MAKING USE OF THE VARIABLE KDTAF.
      K = 0
      L = 1
C
C
      DO 1200 J=1,KDTA
      IF ((T(J).EQ.-5.0).OR.(S(J).EQ.0.0)) GO TO 1180
      D2(L) = D(J)
      T2(L) = T(J)
      S2(L) = S(J)
      L = L+1
      GO TO 1200
 1180 WRITE (6,1190) D(J),T(J),S(J),J
      K = K+1
      JSAV = K
 1190 FORMAT (//5X,3F7.2,I6,//)
 1200 CONTINUE
C
C
 1210 FORMAT (//5X,' JSAV=',I6,//)
      WRITE (6,1210) JSAV
      KDTAF = KDTA-JSAV
      KDTA = KDTAF
C
C
      DO 1220 J=1,1801
      D(J) = 0.0
      T(J) =-5.0
      S(J) = 0.0
 1220 CONTINUE
C
C
C
C
      DO 1230 J=1,KDTA
      D(J) = D2(J)
      T(J) = T2(J)
      S(J) = S2(J)
 1230 CONTINUE
```

```
C
C
C      *****************************************************************
C      ******************* SOUND VELOCITY AND SIGMA-T *****************
C
C      PRODUCE SOUND VELOCITY AND SIGMA-T WHEN IP.EQ.1
      CALL SVEL (D,T,S,SV,KDTA)
      CALL SIGMT (S,T,SIG,KDTA)
C
C      *****************************************************************
C      ************ CONSECUTIVE RECORD SERIALIZATION ROUTINE ***********
C
C      ARRAYS ARE COMPLETE AT THIS POINT FROM INDEX 1 TO THE END OF
C      THE SMALLER OF THE SALINITY OR TEMPERATURE ARRAYS.
C      GENERATE SERIAL NUMBERS FOR THE RECORDS.
      IF (JREC.GT.18) GO TO 1240
      JREC = 1
 1240 CONTINUE
C
C
      DO 1250 J=1,KDTA
      JREC = JREC+1
      IREC(J) = JREC
 1250 CONTINUE
C
C
C      *****************************************************************
C      ************************  O U T P U T  **************************
C
C
C      THIS SECTION CONVERTS THE LETTER DESIGNATOR FOR MONTH(AMONC) FROM
C      THE SINGLE LETTER CODE ON THE DIGITIZED TAPE TO THE APPROPRIATE
C      MONTH AND YEAR IN PREPARATION FOR WRITING THE OUTPUT.
C
C
      DO 1260 J=1,13
      IF (AMONC.EQ.AMONCA(J)) GO TO 1280
 1260 CONTINUE
C
C
 1270 FORMAT (15X,'AMONC NEVER DID EQUAL AMONC(J).  CONSEQUENTLY,
     1WMONTH WILL NOT BE DEFINED.'/)
      WRITE (6,1270)
      GO TO 1290
 1280 WMONTH = EVENT(J)
 1290 CONTINUE
C
C      *****************************************************************
```

```
C      ************** OCEANOGRAPHIC DATA STATION SUMMARIES *************
C
      IF (.NOT.PRT1) GO TO 1300
C
C      PRINT DATA
      WRITE (6,1560)
C      THE PARAMETER ISQZ PERMITS CONDENSING THE PRINTED DATA BY THE
C      FACTOR ISQZ
      CALL OUT1 (D,T,S,SV,SIG,KDTA,ISTA,WMONTH,IREC,JREC,ISQZ)
C
C      *****************************************************************
C      *************************** WRITE TAPE **************************
C
 1300 IF (.NOT.TAPE) GO TO 1340
C      TAPE MUST BE TRUE ONLY ONCE, AT THE BEGINNING OF TAPE  WRITING.
C      WRITE HEADER STATION LABEL HERE.
      WRITE (8,1310) ISTA,WMONTH,KDTA
 1310 FORMAT (I5,A12,I6,17X)
      WRITE (8,1320) (D(J),T(J),S(J),SV(J),SIG(J),J=1,KDTA)
 1320 FORMAT (F6.2,2F6.3,F7.2,F7.4,8X)
C      LRECL WILL BE 40 DIGITS IN LENGTH. PROVIDE APPROPRIATE JCL.
      WRITE (6,1330) ISTA,WMONTH,JREC
 1330 FORMAT (5X,'DATA FOR STATION ',I5,A12,' WRITTEN ON TAPE UP TO
     1 RECORD ',I6)
C
C      *****************************************************************
C      ******************** DATA CARD PUNCH ROUTINE *******************
C
 1340 IF (.NOT.CARDS) GO TO 1430
C
C      PUNCHED DATA IS COMPRESSED BY FACTOR ICSQZ. FORMAT FOR TWO
C      DATA SETS ON A CARD.  KCRD BECOMES THE NUMBER OF DATA PRINTED IF
C      IT IS EVENLY DIVISIBLE. OTHERWISE, LAST DATUM POINT IS PUNCHED.
C      SUPPLY JCL FOR CARD PUNCHING
      KCRD = KDTA/ICSQZ
      NCRDS = KCRD/2
      IDIF = KCRD-2*NCRDS
      IF (IDIF.EQ.0) GO TO 1360
      KCRD = KCRD+1
 1350 FORMAT (24X,'OCEANOGRAPHIC DATA FROM U C M II',//)
 1360 WRITE (7,1350)
      WRITE (7,1370) KCRD,ISTA,WMONTH,ICSQZ
 1370 FORMAT (1X,I4,' VALUES OF D,T,S,SV,SIGMT FOR STATION ',I4,A12,
     1 '  COMPRESSED BY  ',I3,/)
 1380 FORMAT (2X,'DEPTH',3X,'TEMP.',1X,'SALNTY.',1X,'SND.VEL.',1X,
     1 'SIGMA-T',3X,'DEPTH',2X,'TEMP.',1X,'SALNTY.',1X,'SND.VEL.',1X,
     2 'SIGMA-T')
 1390 FORMAT (2X,'METERS',2X,'DEG.C.',1X,'PPT.',4X,'M/SEC',13X,'METERS',
```

```
     1 1X,'DEG.C.',1X,'PPT.',4X,'M/SEC',10X,/)
      WRITE (7,1380)
      WRITE (7,1390)
      ICS2 = ICSQZ*2
      J = 1
      K1 = 1
      KK = ICSQZ
 1400 FORMAT (1X,3F7.2,F9.2,F8.3,3X,3F7.2,F9.2,F8.3)
      WRITE (7,1400) D(K1),T(K1),S(K1),SV(K1),SIG(K1),D(KK),T(KK),S(KK),
     1SV(KK),SIG(KK)
      J = 3
 1410 IF (J.GT.NCRDS) GO TO 1420
      K1 = (J-1)*ICS2
      KK = K1+ICSQZ
      WRITE (7,1400) D(K1),T(K1),S(K1),SV(K1),SIG(K1),D(KK),T(KK),S(KK),
     1SV(KK),SIG(KK)
      J = J+1
      GC TO 1410
 1420 IF (IDIF.EQ.0) GO TO 1430
      K1 = KDTA
      WRITE (7,1400) D(K1),T(K1),S(K1),SV(K1),SIG(K1)
C
C       ****************************************************************
C       *************** HYDROGRAPHIC PROGRAM CARD PUNCH ***************
C
 1430 IF (.NOT.GCARDS) GO TO 1500
      GCRD = KDTA/IGSQZ
      WRITE (7,1350)
 1440 FORMAT (1X,I4,' VALUES OF D , T , AND S  FOR STATION ',I4,A12,
     1 '  COMPRESSED BY  ',I3,/)
      WRITE (7,1440) GCRD,ISTA,WMONTH,IGSQZ
 1450 FORMAT (2X,'DEPTH',7X,'TEMP.',4X,'SALINITY',15X,'STATION',4X,'DATE
     1',5X,'VALUE',9X)
 1460 FORMAT (2X,'METERS',6X,'DEG.C.',5X,'PPT.',51X,/)
      WRITE (7,1450)
      WRITE (7,1460)
      J = 1
      K1 = 1
 1470 FORMAT (1X,F7.1,2X,F9.2,1X,F10.3,18X,I3,A12,'  K1=',I4,I8)
      WRITE (7,1470) D(K1),T(K1),S(K1),ISTA,WMONTH,K1,J
      J = 2
 1480 K1 = (J-1)*IGSQZ
      IF (K1.GE.KDTA) GO TO 1490
      WRITE (7,1470) D(K1),T(K1),S(K1),ISTA,WMONTH,K1,J
      J = J+1
      IF (J.GE.500) GO TO 1500
      GO TO 1480
 1490 K1 = KDTA
```

```
      WRITE (7,1470) D(K1),T(K1),S(K1),ISTA,WMONTH,K1,J
C
C
C      ******************************************************************
C      JREC IS INCREMENTED HERE BY 1 TO ACCOUNT FOR TAPE ID LABEL FOR
C      NEXT STATION TO BE PROCESSED.  THIS KEEPS SERIALIZATION OF
C      RECORDS ON TAPE CONSECUTIVE AND INCLUDES LABELS FOR EACH STATION.
 1500 JREC = JREC+1
C      ******************************************************************
C
C
 1510 IF (ENDFL) END FILE 8
C
C      NORMALLY, ENDFL MUST BE TRUE ONCE ON THE LAST TAPE WRITING
C      OPERATION. HOWEVER, IT IS NOT REQUIRED BY IBM.  IT IS WRITTEN
C      ALWAYS AFTER LAST TAPE WRITING OPERATION WITHOUT COMMAND.
C
C      ****************************************************************
C      ******** INITIALIZE VARIABLES AND ARRAYS FOR NEXT STATION *******
C
C
      DO 1520 J=1,1801
      D(J) = 0.0
      T(J) =-5.0
      S(J) = 0.0
      D2(J) = 0.0
      T2(J) =-5.0
      S2(J) = 0.0
      T1(J) =-5.0
      S1(J) = 0.0
      IREC(J) = 0
 1520 CONTINUE
C
C
      INSA(1) = 1
      INSA(2) = 1
      INTA(1) = 1
      INTA(2) = 1
      KBARF = 0
      KSCARF = 0
C
C
      DO 1530 J=3,10
      INSA(J) = 980
      INTA(J) = 980
 1530 CONTINUE
C
C
```

```
      KS = 1
      KT = 1
C
C
      DO 1540 J=1,50
      SH(J) = 0.0
      TH(J) =-5.0
      DH(J) = 0.0
 1540 CONTINUE
C
C
      SKIP = .FALSE.
      JSAV = 0
      KDTAF = 1
      IDEPTH = 0
      IH = 0
      IP = 0
      IF (NOIRG.EQ.1) GO TO 400
      GO TO 1570
C
C      *****************************************************************
C      ************************* R E T U R N ****************************
C
 1550 CONTINUE
 1560 FORMAT ('1')
 1570 IT = IT+1
      GO TO 150
 1580 STOP
      END
```

```
C     -----------------SUBROUTINE OUT1 MOD1,JUNE 1975--------------------
      SUBROUTINE OUT1 (D,T,S,SV,SIG,N,ISTA,WMONTH,IREC,JREC,ISQZ)
      REAL *8WMONTH
      DIMENSICN D(1), T(1), S(1), SV(1), SIG(1), IREC(1)
C      PRODUCE HEADING
   20 WRITE (6,30) ISTA,WMONTH,ISQZ
   30 FORMAT (//T38,'OCEANOGRAPHIC DATA FROM U C M II'//T41,'STATION ',
     1 I3,A12/T41,'COMPRESSED BY FACTOR ',I3///)
C      FORMAT FOR PRINTING TWO BLOCKS OF DATA PER PAGE.
      WRITE (6,40)
   40 FORMAT (T6,'DEPTH',T14,'TEMP.',T20,'SALNTY.',T28,'SND.VEL.',T36,'
     1 SIGMA-T',T48,'DEPTH',T56,'TEMP.',T62,'SALNTY.',T70,'SND.VEL.',
     2 T80,'SIGMA-T')
      WRITE (6,50)
   50 FORMAT (T6,'METERS',T14,'DEG.C.',T21,'PPT.',T29,'M/SEC',T48,
     1 'METERS',T56,'DEG.C.',T63,'PPT.',T71,'M/SEC'/)
      NN = N/2
      NO = N-2*NN
C
C
      DO 60 J=1,NN,ISQZ
      K = NN+J
      WRITE (6,70) D(J),T(J),S(J),SV(J),SIG(J),D(K),T(K),S(K),SV(K),SIG(
     1K),IREC(J),IREC(K)
   60 CONTINUE
C
C
   70 FORMAT (T6,F5.1,T14,F5.2,T21,F5.2,T28,F7.2,T39,F6.3,T48,F5.1,T56,F
     15.2,T63,F5.2,T70,F7.2,T81,F6.3,T90,2I8)
      IF (NO.EQ.0) GO TO 90
      WRITE (6,80) D(N),T(N),S(N),SV(N),SIG(N),IREC(N)
   80 FORMAT (T48,F5.1,T56,F5.2,T63,F5.2,T70,F7.2,T81,F6.3,T90,8X,I8)
   90 WRITE (6,100)
  100 FORMAT ('1')
      RETURN
      END
```

```
C      ---------------------- SUBROUTINE CHMOVE ----------------------
       SUBROUTINE CHMOVE (A,I,B,J)
C       THIS SUBROUTINE RETURNS A LOGICAL*1 VARIABLE TO A 4-BYTE ADDRESS
C       IN THE MAIN PROGRAM, UNPACKING THE ORIGINAL 4-BYTE WORDS A
C       BYTE AT A TIME.
       LOGICAL *1A(1),B(1)
       B(J) = A(I)
       RETURN
       END
```

```
C     ---------------SUBROUTINE SVEL MOD.1,JUNE 73---------------
      SUBROUTINE SVEL (AA,BB,CC,SV,K1)
C      THIS COMPUTES SOUND VELOCITY FROM DEPTH, TEMPERATURE AND SALINITY
C      ACCORDING TO WILSON'S EQUATION
      DIMENSION AA(1), BB(1), CC(1), SV(1)
C
C
      DO 30 J=1,K1
      Z = AA(J)
      T = BB(J)
      S = CC(J)
      IF (T.LT.-1.99.OR.S.LT.0.1) GO TO 20
      P = .1027*Z+1.282E-7*Z*Z
      T2 = T*T
      T3 = T2*T
      VT = 4.5721*T-4.4532E-2*T2-2.6045E-4*T3+7.9851E-6*T3*T
      P2 = P*P
      P3 = P2*P
      P4 = P2*P2
      VP = .160272*P+1.0268E-5*P2+3.5216E-9*P3-3.3603E-12*P4
      SR = S-35.
      VS = 1.39799*SR+1.69202E-3*SR*SR
      VSTP = SR*(-1.1244E-2*T+7.7711E-7*T2+7.7016E-5*P-1.2943E-7*P2+3.15
     180E-8*P*T+1.579E-9*P*T2)+P*(-1.8607E-4*T+7.4812E-6*T2+4.5283E-8*T3
     2)+P2*(-2.5294E-7*T+1.8563E-9*T2)+P3*(-1.9646E-10*T)
      SV(J) = 1449.14+VT+VP+VSTP+VS
      GO TO 30
   20 SV(J) = 0.
   30 CONTINUE
C
C
      RETURN
      END
```

```
C     ------------------------ SUBROUTINE SIGMT ---------------------
      SUBROUTINE SIGMT (AA,BB,SIG,K1)
C      THIS SUBROUTINE COMPUTES SIGMA-T FROM SALINITY AND
C      TEMPERATURE ACCORDING TO H.O.614 P.91
      DIMENSION AA(1), BB(1), SIG(1)
C
C
      DO 30 J=1,K1
      S = AA(J)
      T = BB(J)
      IF (T.LT.-1.99.OR.S.LT.0.1) GO TO 20
      CL = (S-0.03)/1.805
      B = T*(18.03-0.8164*T+0.01667*T**2)*10.**(-6)
      A = T*(4.7867-0.098185*T+0.0010843*T**2)*10.**(-3)
      SG = -0.069+1.4708*CL-0.001570*CL**2+0.0000398*CL**3
      SGA = -((T-3.98)**2/503.57)*((T+283)/(T+67.26))
      SIG(J) = SGA+(SG+0.1324)*(1-A+B*(SG-0.1324))
      GO TO 30
   20 SIG(J) = 0.
   30 CONTINUE
C
C
      RETURN
      END
```

```
C     ------------------------ SUBROUTINE CONDNS ------------------------
      SUBROUTINE CONDNS (X,Y,T1,JJJ,NE,KDT1,KDTH1,KDTH2)
C
C      SUBROUTINE CONDNS MOD. 3,17 SEPT 74  BY R. G. PAQUETTE.
C
C      THIS SUBROUTINE FINDS THE ARRAY LOCATIONS FOR X, INDEXED
C      SEQUENTIALLY FOR EACH UNIT OF Y.  EACH UNIT OF Y IS 1.0 AND
C      CORRESPONDS TO .01 INCHES OF TRAVEL IN THE DEPTH DIRECTION.
C      MOD. 3 FILLS IN BLANK ARRAY POSITIONS DUE TO THE DIGITIZER STEPP-
C      ING AHEAD MORE THAN .01 INCHES AT A STEP AND WRITES A MESSAGE
C      CN THE PRINTER.
      DIMENSION X(1), Y(1), T1(1), KINS(10), KNO(10)
C
C      IF FIRST INDEX IS ZERO OR NEGATIVE THERE IS A MISBEHAVIOR ELSE-
C      WHERE IN THE PROGRAM.  RESET JJJ TO 1.
      IF (JJJ.GE.1) GO TO 30
      JJJ = 1
      WRITE (6,20)
   20 FORMAT (/5X,'****** JJJ RESET TO ONE - SOMETHING WRONG ******'/)
C      KDTH1 BECOMES THE INDEX OF THE START OF THIS ARRAY SEGMENT.
   30 KDTH1 = Y(JJJ)+1.50
C      IF KDTH1 BECOMES ZERO OR LESS(THE ORIGIN OF MEASUREMENT IS
C      POSITIVE WITH RESPECT TO THE START OF TRACE), USE THE START
C      OF THE CURVE AS THE ORIGIN OF INDEXING.
C      THIS CAUSES AN OVERLAP BETWEEN ARRAYS, BUT IT SHOULD BE SMALL.
      XINC = 0.
      IF (KDTH1.GT.0) GO TO 40
      XINC = FLOAT(1-KDTH1)
      KDTH1 = 1
C
   40 JJ1 = JJJ+1
      NE1 = NE-1
C      FORM SUBSCRIPTS FROM THE DEPTH INCREMENTS AND STORE X'S AT THOSE
C      ARRAY LOCATIONS.
C      SEARCH FOR BLANKS IN ARRAY BETWEEN INDEXES KDTH1 AND KDTH2.
C      KCT COUNTS THE NUMBER OF BLANKS
      KCT = 0
      KSAV = KDTH1
C      KINS(J) IS THE NUMBER OF THE ARRAY POSITION FILLED.
C
C
      DO 50 J=1,10
      KNO(J) = 0
   50 KINS(J) = 0
C
C
C
C
```

```
      DO 80 J=JJ1,NE1
      KDTH = Y(J)+1.50+XINC
      T1(KDTH) = X(J)
C      TEST TO SEE IF INDEX IS THE SAME OR ONE GREATER THAN THE LAST
C      ONE.  IF NOT, INTERPOLATE VALUES.
      NREP = KDTH-KSAV
      IF (NREP.LE.1) GO TO 70
      KCT = KCT+1
      IF (KCT.GT.10) KCT = 10
      KNO(KCT) = NREP
      KINS(KCT) = KDTH
      II = KSAV+1
      III = KDTH-1
      E = FLOAT(NREP)
      G = T1(KDTH)
      F = G-T1(KSAV)
C
C
      DO 60 I=II,III
   60 T1(I) = (FLOAT(I-KSAV)/E)*F+T1(KSAV)
C
C
   70 KSAV = KDTH
   80 CONTINUE
C
C
      KDTH2 = Y(NE)+1.50+XINC
C      INSERT THE FIRST POINT, WHICH OTHERWISE WOULD BE THE LAST
C      ONE FOR WHICH Y(J).LT.1.
      T1(KDTH1) = X(JJJ)
      T1(KDTH2) = X(NE)
C      SAVE INDEX OF END OF ARRAY.
C
C
C      WRITE DOWN NUMBER AND LOCATIONS OF INTERPOLATED VALUES.
      WRITE (6,90) KCT,(KINS(I),I=1,KCT),(KNO(I),I=1,KCT)
   90 FORMAT (/5X,'BLANK ARRAY POSITIONS FILLED IN ',I3,' PLACES.  BEGIN
     1NING INDEXES AND NO. OF STEPS'/5X,'(10 EACH) ARE: ',5X,10I6/
     2 5X,10I6/)
      RETURN
      END
```

A P P E N D I X   E

```
C TITLE          DIGIXBT
C
C
C PROGRAMERS     R.E.BLUMBERG, R.E. GREER. ADAPTED FROM DIGISTD PROGRAM
C                 WHICH WAS AN EXTENSIVE MODIFICATION OF AN ORIGINAL
C                 PROGRAM, MIZ2, BY R.G. PAQUETTE.
C
C DOCUMENTATION  R.E.BLUMBERG
C
C DATE           26 JUNE 1975
C
C PURPOSE        PROGRAM READS AND PROCESSES DIGITIZED TEMPERATURE,AND
C                 DEPTH DATA FROM A CALMA DIGITIZER 7-TRACK TAPE.THE
C                 DATA IS COMPUTED AND STORED FOR EVERY 0.01 OF AN INCH
C                 OF DEPTH INCREMENT ON THE XBT TRACE. PROGRAM COMPUTES
C                 DEPTH AND TEMPERATURE FOR EACH INDIVIDUAL
C                 OCEANOGRAPHIC STATION AND PERMITS PRINTED, PUNCHED
C                 CARD OR 9-TRACK TAPE OUTPUT. NOTE, THIS PROGRAM IS
C                 SET UP TO PROCESS WATER TEMPS BETWEEN 1 AND 25 DEGREES
C                 CELSIUS.
C
C SEQUENCE       THE PROGRAM PERFORMS THESE FUNCTIONS IN THE FOLLOWING
C                 SEQUENCE:
C                   (A) INITIALIZES ALL ARRAYS AND VARIABLES
C                   (B) SKIPS XXX NUMBER OF RECORDS IF NSKP=GREATER THAN
C                     ZERO.
C                   (C) READ PAIR OF DATA CARDS (LABEL AND DAT) FOR
C                     RECORD BEING PROCESSED. COUNT RECORDS.
C                   (D) PROGRAM TERMINATES IF ISTOP=1 OR DESIRED NUMBER
C                     OF RECORDS PROCESSED.
C                   (E) HEADER INFO MISSING ON TAPE, INSERT ON CARDS BY
C                     SETTING IHDR=1.
C                   (F) SKIP UNREADABLE OR BAD RECORD IF NRCSKP SET
C                     EQUAL TO THE BAD RECORD NUMBER.
C                   (G) READ USABLE RECORD INTO THE A ARRAY
C                   (H) MOVE BYTES OF A ARRAY INTC 4-BYTE WORDS OF B
C                     ARRAY TO ALLOW PROCESSING BY STANDARD FORTRAN.
C                   (I) PROCESS RAW B ARRAY
C                      (1) IF HEADER RECORD, PROGRAM DECODES HEADER
C                        LABEL AND COMPARES TO LABEL SUPPLIED BY DATA
C                        CARD.
C                      (2) IF TRACER RECORD, PROGRAM ADDS AND STORES
C                        CUMULATIVE SUMS OF X AND Y DISTANCE TRAVEL.
C                        SUBROUTINE CONDNS INDEXES THE VALUES OF
```

```
C                    CUMULATIVE DISTANCE BY INCREASING DEPTH UNITS.
C                (J) CONVERT THE X AND Y ARRAYS TO DEPTH AND
C                  TEMPERATURE.
C                (K) MANUALLY INSERT SURFACE AND NEAR SURFACE VALUES
C                  VIA DATA CARDS.
C                (L) ELIMINATE EXCESSIVELY HIGH OR LOW VALUES.
C                (M) COMPUTE CONSECUTIVE RECORD SERIALIZATION FOR
C                  TAPE OUTPUT NUMBERING SCHEME.
C                (N) CONVERTS LETTER DESIGNATOR MONTH/YEAR CODE,
C                  AMONC, TO REAL*8 MONTH AND YEAR.
C                (O) DATA OUTPUT IN EITHER REGULAR PRINTOUT, TAPE, OR
C                  PUNCHED CARDS. CARD OUTPUT SUITABLE FOR THESIS1.
C                (P) INITIALIZE ARRAYS AND VARIABLES FOR PROCESSING
C                  NEXT STATION'S DATA.
C                (Q) REPEAT STEPS (C) THRU (P) UNTIL ALL RECORDS ARE
C                  PROCESSED, ISTOP=1, OR THE NUMBER OF DESIRED
C                  RECORDS (NN) ARE READ.
C
C FEATURES      THIS IS A HIGHLY VERSATILE PROGRAM FOR PROCESSING
C                 OCEANOGRAPHIC DATA FROM 7-TRACK TAPE. FEATURES OF THE
C                 PROGRAM ARE LISTED UNDER THE FOLLOWING SIX GENERAL
C                 CATEGORIES:
C                (A) INPUT
C                   (1) 7-TRACK CALMA DIGITIZER TAPE IN BCD.
C                   (2) TWO DATA CARDS REQUIRED PER TRACE SEGMENT
C                     RECORD OR HEADER LABEL RECORD. AN XBT TRACE
C                     REQUIRES 4 CARDS, ONE PAIR FOR THE HEADER AND
C                     ONE PAIR FOR THE TRACE. THE FOLLOWING IS A
C                     SAMPLE DATA DECK SHOWING DATA CARDS FOR STATION
C                     207 AND 208. ALSO SHOWN IS THE 'STATION END'
C                     CARD WITH ISTOP SET EQUAL TO ONE. THIS IS
C                     FOLLOWED BY THE JCL NECESSARY TO READ THE 7-
C                     TRACK TAPE.COLUMN 1 IS BLANK ON THE DATA CARDS.
C     &CONTRL NN=104,IDSCL=1,ICODE=0,ITSCL=1,ISCL=1,IP=1,ISQZ=01,
C     ICSQZ=3,TAPE=F,CARDS=F,TCOR=-.13,XBTCOR=0.0,NSKP=6,&END
C         UCMXBT STATIONS 201V THRU 317V TAPE UCM011
C         HEADER XBT
C     &DAT IDEPTH=99,ISTA=207,AMONC='V',&END
C         TRACER XBT                                               V
C     &DAT  IDEPTH=00,DH=0.0,TH=12.12,IH=1,&END
C         HEADER XBT
C     &DAT IDEPTH=99,ISTA=208,AMONC='V',&END
C         TRACER XBT                                               V
C     &DAT  IDEPTH=00,&END
C          STATION END                                      1
C    //GO.METTAP DD UNIT=2400-1,VOL=SER=UCM011,DISP=OLD,LABEL=(,NL),
C    //      DCB=(DEN=1,TRTCH=ET)
C                (B) SUBROUTINES
```

```
C                          (1) TPRD-READS THE 7-TRACK MAGNETIC TAPE.
C                          (2) CHMOVE- TAKES THE DATA THAT HAS BEEN READ
C                            INTO THE A ARRAY AND STORES IT IN USABLE FORM
C                            IN THE B ARRAY.
C                          (3) CONDNS- INDEXES THE VALUES OF CUMULATIVE
C                            DISTANCE BY INCREASING DEPTH UNITS.
C                          (4) OUT2- PRINTS OUT OCEANCGRAPHIC STATION DATA.
C                       (C) AUTOMATIC DATA PROCESSING/HANDLING
C                          (1) HANDLES OPERATOR MISTAKES MADE IN TRACING XBT
C                            CURVES ON CALMA DIGITIZER.
C                          (2) SKIPS INITIAL NUMBER AND INDIVIDUAL BAD
C                            RECORDS ON 7-TRACK TAPE.
C                          (3) DECODES 7-TRACK TAPE HEADER LABELS AND TRACE
C                           RECORDS.
C                          (4) COMPUTES DATA FOR EVERY 0.01 INCH OF CALMA
C                            DIGITIZER STYLUS MOVEMENT.
C                          (5) ALLOWS ENTRY OF HAND ENTERED DATA FOR
C                            SURFACE AND NEAR SURFACE VALUES.
C                          (6) EDITS OUT EXCESSIVELY LOW & HIGH VALUES.
C                          (7) PROVIDES CONSECUTIVE RECORD SERIALIZATION
C                            FOR TAPE OUTPUT.
C                       (D) DIAGNOSTICS
C                          (1) WRITES FIRST TWENTY FIVE VALUES OF DEPTH AND
C                            TEMPERATURE FOR DATA INSPECTION.
C                       (E) TROUBLE-SHOOTING
C                          (1) HANDLES MULTIPLE KEYBOARD AND TRACER SYMBOL
C                            ENTRIES.
C                          (2) PROVIDES FOR A MISSED OR INCOMPLETE HEADER
C                            LABEL.
C                          (3) HANDLES MISSING INTER-RECORD GAP (IRG).
C                          (4) HANDLES DELETE RECORD BY INCREMENTING RECORD
C                            COUNT AND READING SAME PAIR OF CARDS AGAIN.
C                          (5) COMPARES CARD HEADER LABEL AND TAPE HEADER
C                            LABEL AND ACCEPTS CARD VALUES IF CARD AND TAPE
C                            DISAGREE.
C                       (F) OUTPUT
C                          (1) PRINTER- TWO PRINTING VARIABLES, PRT1 AND
C                            PRT2. PRT2 PROVISION ONLY.
C                          (2) CARD-PUNCHED DATA CARDS SUITABLE FOR USE WITH
C                            THESIS1.
C                          (3) TAPE- 9-TRACK TAPE
C                          (4) PLOTTING- PROVISION FOR PLOTTING ROUTINES
C                            ACTUATED BY PLT1 AND PLT2 ARE NOT PRESENTLY
C                            PROGRAMMED.
C
C ARGUMENTS        PROGRAM CONSISTS OF MANY TERMS,ARRAYS,AND VARIABLES.
C                    SOME OF THESE VARIABLES ARE USED IN THE DIGISTD
C                    PROGRAM. THEY WERE INCLUDED IN THIS PROGRAM TO KEEP
```

```
C             THE HEADER LABEL PROCESSING ON THE CALMA DIGITIZER
C             THE SAME FOR BOTH STD AND XBT TRACES. THESE VARIABLES
C             ARE IDENTIFIED BELOW AND ARE SET EQUAL TO A CONSTANT
C             IN THIS PROGRAM.
C             THE FOLLOWING IS A BRIEF DESCRIPTION OF THE
C             IMPORTANT ARGUMENTS LISTED ALPHABETICALLY UNDER TWO
C             GENERAL CATEGORIES:
C
C              (A) ARRAYS
C                D,T       = DEPTH,TEMPERATURE
C                DH,TH     = HAND-ENTERED SURFACE OR NEAR SURFACE
C                           DATA
C                X,Y       = CUMULATIVE SUMS CF DISTANCE TRAVELED BY
C                           THE DIGITIZER STYLUS. STORAGE IS
C                           PROVIDED FOR 20 INCHES TOTAL TRAVEL
C                           OF THE STYLUS ON EACH COORDINATE
C                           AXIS. THIS INCLUDES BOTH PLUS AND MINUS
C                           DIRECTIONS.
C                NRCSKP    = NUMBER OF THE INDIVIDUAL RECORD SKIPPED
C                DCON      = DEPTH CONSTANT  NUMBER OF 0.01 INCHES
C                           PER UNIT OF DEPTH.
C                IREC      = CONSECUTIVE SERIAL RECORD NUMBER FOR
C                           TAPE
C                AMONCA    = MONTH/YEAR CODE LETTER.
C                EVENT     = MONTH AND YEAR.
C
C              (B) VARIABLES
C                CARDS     = PERMITS PUNCHING CARDS
C                CONTRL    = NAMELIST VARIABLE USED FOR INFREQUENTLY
C                           CHANGED VARIABLES.
C                DCOR      = DEPTH CORRECTION TERM.
C                DAT       = NAMELIST VARIABLE USED FOR
C                           FREQUENTLY CHANGED VARIABLES.
C                DLTREC    = DELETE RECORD
C                FLAG      = INDICATES START OF DATA TRACE.
C                ICODE     = VARIABLE HELD OVER FROM DIGISTD
C                           ICODE IS A CONSTANT = ZERO.
C                ICSQZ     = VARIABLE USED TO COMPRESS NUMBER OF
C                           DATA POINTS PUNCHED ON CARDS.
C                IDENT     = VARIABLE USED TO IDENTIFY HEADER
C                           LABEL, (IDENT =99) OR TRACE RECORD
C                           (IDENT = 00).
C                IDSCL     = VARIABLE HELDOVER FROM DIGISTD PROGRAM
C                           IDSCL IS A CONSTANT = 1.
C                IH        = NUMBER OF HAND ENTERED SURFACE OR
C                           NEAR-SURFACE DATA VALUES.
C                IHDR      = VARIABLE USED TO IDENTIFY MISSED HEADER
C                           LABEL ON TAPE. ALLOWS MISSING INFO TO BE
```

```
C                              INSERTED ON CARDS.
C                   IP       = VARIABLE IDENTIFIES LAST RECORD OF
C                              PARTICULAR STATION. SINCE XBT IS A
C                              SINGLE TRACE IP IS A CONSTANT = 1.
C                   ISCL     = VARIABLE HELD OVER FROM DIGISTD
C                              PROGRAM ISCL IS A CONSTANT = 1.
C                   ISQZ     = VARIABLE USED TO COMPRESS NUMBER
C                              OF DATA POINTS PRINTED BY PRINTER.
C                   ISTA     = VARIABLE IDENTIFIES STATION NUMBER.
C                   ISTOP    = VARIABLE TERMINATES PROGRAM IF = 1 ON
C                              FINAL &DAT CARD.
C                   ITSCL    = VARIABLE HELDOVER FROM DIGISTD PROGRAM
C                              ITSCL IS A CONSTANT = 1.
C                   JREC     = VARIABLE USED TO COUNT RECORDS FOR
C                              RECORD SERIALIZATION PURPOSES.
C                   JSKIP    = VARIABLE USED TO CONTRL NUMBER OF
C                              DATA CARDS READ.
C                   KEY      = KEYBOARD SYMBOL ON THE DIGITIZED TAPE.
C                   KDTH2    = NUMBER OF RECORD PROCESSED FOR
C                              PARTICULAR STATION.
C                   LABEL    = HEADER TYPE DATA CARD WHICH
C                              IDENTIFIES STATION NUMBER, MONTH, ETC.
C                   NCRDS    = NUMBER OF CARDS PUNCHED BY CARDS
C                              PUNCHING ROUTINE.
C                   NE       = AN INDEX AT THE LAST USEFUL ARRAY
C                              POSITION OF THE X(DEPTH) ARRAY.
C                   NOIRG    = VARIABLE USED TO INDICATE MISSING
C                              END OF RECORD GAP ON TAPE.
C                   NPTS     = NUMBER OF DATA POINTS TO BE PUNCHED
C                              BY CARDS PUNCHING ROUTINE.
C                   NSKP     = NUMBER OF INITIAL RECORDS ON TAPE
C                              TO BE SKIPPED
C                   TCOR     = CORRECTION FACTOR ADDED TO
C                              TEMPERATURE DATA VALUES.
C                   WMONTH   = REAL*8 -MONTH AND YEAR
C      ------------------------ SUBROUTINE TPRD ------------------------
C      TPRD IS IN ASSEMBLER LANGUAGE AND REQUIRES SPECIAL JCL.
C      THE COMMENT CARDS ARE INCLUDED HERE BECAUSE NO COMMENT CARDS ARE
C      ALLOWED TO BE MIXED WITH THE ASSEMBLER LANGUAGE SUBROUTINE.
C      A  /*  FOLLOWED BY A  //ASM.SYSIN DD *  MUST PRECEDE THE DECK.
C      THIS DECK IS RUN UNDER // EXEC FORTCALG.
C      TPRD IS A MODIFIED VERSION OF TAPRD, WHICH ALLOWS THE USER TO
C      READ MAGNETIC TAPE RECORDS WHICH CANNOT BE READ BY STANDARD
C      METHODS. TPRD DIFFERS FROM TAPRD ONLY IN THAT IT ALLOWS
C      RECORDS TO BE SKIPPED. THIS IS ACCOMPLISHED BY ALTERING THE
C      FOLLOWING CARDS:
C
C         CARD NO.       TAPRD VERSION               TPRD VERSION
```

```
C          TPRO1430       TAPRD   CSECT              TPRD   CSECT
C          TPRO1910       MVI   TPCCW,X'3F'          MVI   TPCCW,X'37'
C          TPRO2990       TAPRD   CSECT              TPRD   CSECT
C
C      CTHERWISE, THE PROGRAMS ARE IDENTICAL. A LISTING OF TPRD VERSION
C      MINUS THE DOCUMENTATION IS PROVIDED BELOW.  SEE W.R.CHURCH
C      COMPUTER CENTER LIBRARY FOR LISTING OF TAPRD AND APPLICABLE
C      DOCUMENTATION.
C
      DIMENSION X(4001), Y(4001), LABEL(19), TH(12), DH(12), IREC(1801),
     1 NRCSKP(99), DCON(1), AMONCA(13), EVENT(13), D(1801), T(1801)
      INTEGER B(8001),ZER,DOL,STAR,ONE,FLAG,DLTREC,DLR,BLANK,A(2001),TWO
     1,THREE,FOUR,FIVE,SIX,SEVEN,EIGHT,TEN,ELEVEN,AMONT
      LCGICAL PRT1,PRT2,PLT1,PLT2,TAPE,ENDFL,CARDS,SKIP
C      *****************************************************************
C
      NAMELIST /CONTRL/ NN,PRT1,PRT2,PLT1,PLT2,TAPE,ENDFL,CARDS,ISTCP,IP
     1,IH,NRCSKP,NSKP,JSKIP,ISQZ,IDSCL,ICODE,ITSCL,ISCL,XBTCOR,ICSQZ,TCO
     2R/DAT/TH,DH,IH,ICODE,ISCL,ITSCL,IDSCL,IP,IDEN,ISQZ,ITSQZ,ICSQZ,TCO
     3R,IHDR,NOIRG,CARDS,ISTA,DCON,DCOR,SKIP,AMONC,TAPE
C
C      *****************************************************************
C
      REAL *8EVENT,WMONTH
      DATA AMONCA/'H','I','C','K','L','O','P','Q','R','U','V','W','Z'/
      DATA EVENT/'AUG 1973','SEP 1973','OCT 1973','NOV 1973','DEC 1973',
     1'JAN 1974','FEB 1974','MAR 1974','APR 1974','MAY 1974','JUN 1974',
     2'JUL 1974','AUG 1974'/
C
C      DEFINE SYMBOLS, NOTEING THAT THE LEFT THREE HEX BYTES IN EACH
C      ELEMENT OF B END UP FILLED WITH BLANKS
      DATA DOL/'$$$$'/,STAR/Z4040405C/,KEY/Z4040405F/,ONE/Z404040F1/,
     1FLAG/Z40404050/,DLTREC/Z40404060/,MINUS/Z40404061/,
     2 DLR/Z4040405B/,BLANK/'    '/,ZER/Z404040F0/,TWO/Z404040F2/,
     3THREE/Z404040F3/,FOUR/Z404040F4/,FIVE/Z404040F5/,
     4MTWO/Z404040E2/,MTHREE/Z404040E3/,MFOUR/Z404040E4/,MFIVE/Z404040E5
     5/,SIX/Z404040F6/,SEVEN/Z404040F7/,EIGHT/Z404040F8/,NINE/Z404040F9
     6/,TEN/Z404040F0/,ELEVEN/Z4040407B/
C
C      *****************************************************************
C***(A) INITIALIZE VARIABLES AND ARRAYS.********************************
C
C     THE FOLLOWING CONVERSION FACTOR IS IN HUNDREDS OF INCHES PER
C      UNIT OF T. IT MAY BE OVERRIDDEN BY THE DATA CARDS.
      DCON(1) = 1.0475
C
      DATA CARDS/.FALSE./,DCOR/0.0/,ENDFL/.FALSE./,FG/0./,ICODE/0/,ICSQZ
     1/1/,IDSCL/1/,IH/0/,IHDR/0/,IP/0/,IPS/8000/,ISCL/1/,ISQZ/1/,ISTOP/0
```

```
     2/,ITSCL/1/,ITSQZ/1/,JJJ/0/,JJJJ/0/,JREC/1/,JSAV/0/,KDTH1/1/,KDTH2/
     31/,NE/0/,NOIRG/0/,NSKP/0/,PLT1/.FALSE./,PLT2/.FALSE./,PRT1/.TRUE./
     4,PRT2/.FALSE./,SKIP/.FALSE./,TAPE/.FALSE./,TCOR/0./
C
C       GIVE THE ARRAYS INITIAL VALUES
C
C
C
      DC 20 J=1,12
      TH(J) = 0.
      DH(J) = 0.
   20 CCNTINUE
C
C
C
C
      DO 30 J=1,1801
      D(J) = 0.
      T(J) = 0.
   30 CONTINUE
C
C
C
C
      DO 40 J=1,99
      NRCSKP(J) = 0
   40 CONTINUE
C
C
C
      READ (5,CONTRL)
      READ (5,140) LABEL
      WRITE (6,150) LABEL
C       REWIND HERE IF TAPE IS USED. NOTE THAT IF TAPE=T,JCL
C       MUST BE PROVIDED TO DEFINE IT.
      IF (TAPE) REWIND 8
      IF (NSKP.EQ.0) GO TO 110
C
C       *****************************************************************
C***(B) SKIP RECORDS.***************************************************
C
C       NOTE: THE PROGRAM DIFFERENTIATES BETWEEN INITIALLY SKIPPED
C       RECORDS (NSKP) AND BAD RECORDS (NRCSKP).  NRCSKP
C       REQUIRES DATA CARDS FOR BAD RECORDS SKIPPED AND NSKP
C       DOESN'T. PLUS NRCSKP ONLY SKIPS A SINGLE RECORD FOR EACH
C       VALUE ASSIGNED TO NRCSKP, WHEREAS NSKP SKIPS MULTIPLE
C       RECORDS (IE. NSKP=40, THE FIRST 40 RECORDS ON THE TAPE
C       WILL BE SKIPPED.) NSKP
```

```
C       AS WELL AS THE 10 VALUES OF NRCSKP MUST BE ON THE FIRST
C       CONTRL CARD ONLY. A SINGLE CONTRL CARD IS READ HERE AT THE
C       START TO SET NSKP AND NRCSKP.
C
C
C
C
      DO 50 IS=1,NSKP
      IIS = IS
C       IPS IS SET NEGATIVE DURING THE SKIP PROCESS. THIS AVOIDS TPRD
C       STOPPING ON UNREADABLE RECORDS. IPS IS THE MAXIMUM NUMBER OF
C       BYTES CF DATA WHICH WILL BE READ FROM ONE RECORD OF DIGITIZER
C       TAPE BY TPRD. IPS/2 IS THE MAXIMUM TOTAL TRAVEL ALONG THE CURVE
C       MEASURED IN HUNDREDTHS OF AN INCH IN THE X AND Y DIRECTIONS
C       SEPARATELY. NO DATA CARDS ARE NEEDED FOR SKIPPED RECORDS.
      IPS = -8000
   50 CALL TPRD (A,IPS,&70,&90)
C
C
C
C       RESET IPS FOR NORMAL TAPE READING
      IPS = 8000
      WRITE (6,60) IIS
   60 FORMAT (/5X,I5,' RECORDS SKIPPED'/)
      GO TO 110
C
C       END AND ERROR MESSAGES.  PROGRAM STOPS
   70 WRITE (6,80) IIS
   80 FORMAT (/5X,'FOUND END OF FILE ON RECORD',I4,'DURING SKIP PROCESS'
     1 /)
      GO TO 1370
   90 WRITE (6,100) IIS,A(1),A(2),A(3),A(4)
  100 FORMAT (/5X,'READ ERROR ON RECORD',I5,'ERROR STATISTICS ARE: ',4Z8
     1)
      GC TO 1370
C
C       REDEFINE LOOP INDEX TO START AT ONE.
  110 NNN = NN-NSKP
C
C       ***********************************************************
C***(C) READ CARDS AND START MAIN LOOP. COUNT RECORDS.*****************
C       ***********************************************************
C***(D) TERMINATE PROGRAM IF ISTOP=1 OR NUMBER OF RECORDS PROCESSED.****
C
      IT = 1
  120 IF (IT.GT.NNN) GO TO 1370
      IFS = 8000
      NREC = IT+NSKP
```

```
      WRITE (6,130) NREC
  130 FORMAT (/5X,'LABEL 130 ; START MAIN LOOP.  RECORD NO. ',I3/)
C      THE NUMBER OF RECORDS TREATED IS DETERMINED BY SETTING
C      NN= NUMBER OF RECORDS ON THE CONTRL CARD. CR THE PROGRAM MAY
C      BE STOPPED BY SETTING ISTOP.GT.0 ON THE LABEL CARD.
C      THE LABEL CARD HAS THE LAST FOUR COLUMNS FOR CONTROL ALTHOUGH
C      ONLY THREE ARE USED HERE. THE 77-TH COLUMN IS JSKIP; IF IT
C      IS ZERO, ONLY TWO CARDS ARE READ. IF IT IS 1 AN ADDITIONAL CARD,
C      AN &CONTRL CARD, CAN ALSO BE READ. THE 78-TH COLUMN IS ISTOP;
C      IF IT IS =1 THE PROGRAM STOPS. THE 79-TH CCLUMN IS AMONC;
C      IT IS AN ALPHABETIC CHARACTER THAT DESIGNATES THE MONTH
C      IN WHICH THE DATA WERE TAKEN. NOTE THAT THIS NEEDS TO BE
C      ON THE LAST CARD SET READ BEFORE PRINTING. AMONC MAY ALTERNATELY
C      BE ADDED ON THE &DAT HEADER CARD.
      READ (5,140) LABEL,JSKIP,ISTOP,AMONC
  140 FORMAT (19A4,2I1,A1)
      IF (ISTOP.GT.0) GO TO 1370
      READ (5,DAT)
      WRITE (6,150) LABEL
      WRITE (6,DAT)
C      NORMALLY TWO DATA CARDS ARE EXPECTED TO BE READ PER RECORD,
C      LABEL AND DAT.  LESS FREQUENTLY CHANGED NUMBERS ARE ON CONTRL.
      JJJJ = 0
      NCIRG = 0
      IF (JSKIP.EQ.0) GO TO 160
      READ (5,CONTRL)
      WRITE (6,CONTRL)
  150 FORMAT (/5X,19A4/)
C
C      *****************************************************************
C***(E) HEADER INFO MISSING.********************************************
C
C      IHDR=1 ON &DAT PROVIDES FOR MISSED HEADER INSERT ALL THE
C      HEADER INFO ON CARDS, BRANCH TO 540 AND THEN RETURN TO START AT
C      120 WITHOUT INCREMENTING THE RECORD COUNT.
  160 IF (IHDR.EQ.1) GO TO 540
  170 CCNTINUE
C
C      DIAGNOSTIC WRITE STATEMENTS FOLLOW:
C
  180 FCRMAT (5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.
     12/5X,11F7.2/5X,11F7.2/5X,3F7.2,60X,I6)
  190 FORMAT (7X,' JJJ,  NE  ,KDTH1,KDTH2,JJJJ'/4X,5I6)
      IPLACE = 170
      WRITE (6,180) (D(J),J=1,1801,20),IPLACE
      WRITE (6,180) (T(J),J=1,1801,20),IPLACE
      WRITE (6,190) JJJ,NE,KDTH1,KDTH2,JJJJ
C--------------------
```

```
C
C      FILL THE A ARRAY WITH DOLLARS
C
C
C
      DO 200 I=1,2001
C      THE 2001 ASSURES THAT THE LAST WORD OF A WILL CONTAIN DOLLARS
C      SINCE WE READ IN ONLY 8000 BYTES OF DATA.
  200 A(I) = DOL
C
C
C
C      FILL B WITH BLANKS
C
C
C
      DO 210 I=1,8000
  210 B(I) = BLANK
C
C
C
C      *****************************************************************
C***(F) SKIP BAD RECORDS.***********************************************
C
C      THE LIST OF BAD RECORDS IS EXAMINED AND SKIPPED.
C      DO NOT REMOVE THE DATA CARDS FOR THE BAD RECORD.
C      NOTE THAT IF NRCSKP(1) IS ZERO, THE TEST IS SKIPPED.
      IF (NRCSKP(1).EQ.0) GO TO 250
C
C
C
      DO 220 J=1,99
      NRC = NRCSKP(J)-NSKP
      IF (NRC.EQ.IT) GO TO 230
  220 CONTINUE
C
C
C
      GO TO 250
C      CHANGING IPS TO NEGATIVE CAUSES TPRD TO SKIP A RECORD
  230 IPS = -8000
  240 FORMAT (//5X,'LABEL 240. RECORD NO.',I5,' SKIPPED VIA NRCSKP SKIP
     1 ROUTINE.'//)
      WRITE (6,240) IT
C
C      *****************************************************************
C***(G) READ USABLE RECORD INTO A ARRAY.********************************
C
```

```
  250 CALL TPRD (A,IPS,&280,&260)
C
C      IPS IS THE MAXIMUM SIZE OF THE ORIGINAL BCD RECORD. THIS SIZE
C      / 200 IS THE MAXIMUM DISTANCE THE STYLUS CAN TRAVEL, + AND/OR -,
C      IN EITHER THE X OR THE Y DIRECTION; 60 IS THE END-OF-FILE EXIT,
C      2 IS THE READ-ERROR EXIT.
      GO TO 290
  260 WRITE (6,270) A(1),A(2),A(3),A(4)
  270 FORMAT (5X,'THE ERROR STATISTICS TABLE IS ',4Z8)
  280 CONTINUE
  290 CONTINUE
C
C      *****************************************************************
C***(H) MOVE BYTES OF A ARRAY INTO B ARRAY.*****************************
C
      JJ = 0
      JJJ = 0
C
C
C
      DO 300 II=1,2000
C
C
C
      DO 300 I=1,4
      JJ = JJ+1
      CALL CHMOVE (A(II),I,B(JJ),4)
      IF (B(JJ).EQ.DLR) GO TO 310
C      END OF DATA DETECTED
  300 CONTINUE
C
C
  310 CONTINUE
C
C
      B(8001) = DLR
C
C      *****************************************************************
C***(I) PROCESS B ARRAY.************************************************
C
C      A DIAGNOSTIC WRITE STATEMENT FOLLOWS:
      WRITE (6,320) JJ,(B(J),J=1,25)
  320 FORMAT (/5X,'LABEL 320. ARRAY B IS FILLED; LOOK FOR MODE CHARACTER
     1. THE NUMBER OF ARRAY ELEMENTS PROCESSED INCLUDING STARS AND '/
     25X,'DOLLARS, JJ= ',I5,/5X,'FIRST 25 CHARACTERS ARE: ',
     3 10(1X,Z8)/5X,10(1X,Z8)/5X,5(1X,Z8)/)
C      TEST TO SEE IF THIS IS A KEYBOARD ENTRY OR A STAR (TRACER)
C      AND PERMIT THE POSSIBILITY THAT EITHER 'KEYBOARD' OR 'TRACER'
```

```
C       BUTTONS HAVE BEEN PUSHED TWICE.
C
C       IN USING THE CALMA DIGITIZER, SPURIOUS BLANK RECORDS WOULD
C       APPEAR AT RANDOM THROUGHOUT THE TAPE. WHEN THESE BLANK RECORDS
C       OCCUR DURING A HEADER RECORD NOTHING IS LOST SINCE HEADER
C       INFO IS EASILY INSERTED VIA DATA CARDS BY SETTING IHDR=1.
C       HOWEVER, IF A BLANK RECORD OCCURS DURING A TRACE RECORD THE
C       COMPLETE STATION IS LOST.  FROM EXPERIENCE A BLANK RECORD
C       NORMALLY WILL HAVE TWO CHARACTERS (IE. JJ=2). AFTER THE FIRST
C       RUN THE BLANK RECORDS CAN BE LOCATED AND CAN THEN BE SKIPPED
C       INDIVIDUALLY OR THE ENTIRE STATION CAN BE SKIPPED DEPENDING
C       ON WHETHER THE BLANK RECORD IS IN THE HEADER OR TRACE.
C       THIS PROBLEM IS SUSPECTED TO BE THE RESULT OF MECHANICAL
C       PROBLEMS WITH THE DIGITIZER ITSELF AND SHOULD NOT BE A
C       RECURRING PROBLEM.
      JJ = 1
      GO TO 360
C
C       THE FOLLOWING ROUTINE READS ANOTHER SET OF CARDS.  THIS IS THE
C       ENTRY FOR THE SITUATIONS IN WHICH THE IRG IS MISSED.
  330 READ (5,140) LABEL,JSKIP,ISTOP,AMONC
      IF (ISTOP.GT.0) GO TO 1370
      IF (JSKIP.EQ.0) GO TO 340
      READ (5,DAT)
      WRITE (6,150) LABEL
      WRITE (6,DAT)
      READ (5,CONTRL)
      WRITE (6,CONTRL)
C       DIAGNOSTIC WRITE STATEMENTS FOLLOW:
  340 IPLACE = 185
      WRITE (6,180) (D(J),J=1,1801,20),IPLACE
      WRITE (6,180) (T(J),J=1,1801,20),IPLACE
      WRITE (6,190) JJJ,NE,KDTH1,KDTH2,JJJJ
C
      WRITE (6,350) NOIRG,JJJJ
  350 FORMAT (/5X,'LABEL 185.  PROCESSING SECOND HALF.  NOIRG=',I3,
     1 'JJJJ=',I5/)
      NOIRG = 0
      JJ = JJJJ
C
C       INITIALIZE ADDERS,ETC.
  360 SUMD = 0.
      SUMT = 0.
      N = 0
      KL = 0
C
C       ***********************************************************
C***(1) DECODE HEADER LABEL.*****************************************
```

```
C
C      DIAGNOSTIC WRITE STATEMENTS FOLLOW:
  370 FORMAT (/5X,'B(JJ)=',Z8/)
  380 FORMAT (5X,I5/)
      WRITE (6,380) JJ
      WRITE (6,370) B(JJ)
C      LOOK FOR KEYBOARD SYMBOL.
C      CHECK THE FIRST 11 VALUES OF THE B ARRAY FOR A KEYBOARD
C      SYMBOL SINCE IT IS POSSIBLE TO HAVE BAD OR INVALID SYMBOLS AHEAD
C     OF KEYBOARD SYMBOL OF HEADER. IF ALL ELEVEN VALUES ARE NCT KEYS,
C      RESET JJ TO 1 (IE.JJ=JJ-10) AND PROCESS AS A TRACE. HOWEVER
C      IF ONE OF THE VALUES 1 THRU 11 IS A KEY GO TO 264 AND
C      PROCESS AS A HEADER.
C      IF A TRACER SYMBOL IMMEDIATELY FOLLOWS A KEY SYMBOL, THE HEADER
C      IS PROBABLY MISSING AND THE SEGMENT IS PROSESSED AS A TRACE.
C      (NOTE 1: IN THE CASE OF A HEADER JJ IS NOT RESET TO 1.
  390 IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ+1
      IF (B(JJ).EQ.KEY) GO TO 850
      JJ = JJ-10
  400 FORMAT (5X,'LABEL 400.',I5)
      WRITE (6,400) JJ
      IF (KL.EQ.1) GO TO 430
      IF (KL.EQ.2) GO TO 430
C      NO KEYBOARD SYMBOL; MAY HAVE FORGOTTEN IT.  TEST THE 5TH AND
C      6TH SYMBOLS (IDEPTH).  IF BOTH ARE NINES CALL IT A KEYBOARD
C      ANYWAY.
      IF (B(5).EQ.NINE.AND.B(6).EQ.NINE) GO TO 410
      GO TO 590
  410 IJJ = JJ+12
```

```
      WRITE (6,420) (B(I),I=JJ,IJJ)
  420 FORMAT (/5X,'AT 410, MISSING KEY.  B(1) TO B(13)=',13A1/)
C
C      PROCESS KEYBOARD ENTRIES.  CHANGE THE WORDS TO
C      INTEGER FORM BY SUBTRACTING Z404040F0 AND CREATE MULTI-DIGIT
C      INTEGERS.
C      SKIP=T PERMITS NAMELIST DATA CARDS TO OVERRIDE TAPE HEADING
C      INFO. ALL HEADING DATA MUST THEN BE PUT ON THE CARDS.
  430 IF (SKIP) GO TO 540
      ISTAA = 0
      IDENT = 0
C      DEFINE INDICES FOR DECODING THE LABEL
      KY1 = JJ
      KY2 = KY1+2
      KY3 = KY1+3
      KY4 = KY1+4
      KY5 = KY1+5
      KY6 = KY1+6
      KY7 = KY1+7
      KY8 = KY1+8
      KY9 = KY1+9
      KY10 = KY1+10
      KY11 = KY1+11
C
C      IF THERE IS A DLTREC IN THE HEADER, IT IS FOUND HERE. READ IN A
C      NEW RECORD, AND USE THE SAME CARDS.
C
C
C
      DO 440 J=KY1,KY10
      IF (B(J).EQ.DLTREC) GO TO 450
  440 CONTINUE
C
C
C
      GO TO 480
  450 WRITE (6,460)
  460 FORMAT (/5X,'DLTREC IN HEADER. REPEAT,USING SAME CARDS.'/)
  470 IT = IT+1
      GO TO 170
C
C      DO THE CONVERSION, COMPARE WITH VALUES READ FROM THE CARDS,ACCEPT
C      THE CARDS.
C
  480 CONTINUE
C
C
C
```

```
      DO 490 J=KY1,KY2
      B(J) = B(J)-ZER
      IB = B(J)
  490 ISTAA = ISTAA+IB*10**(KY2-J)
C
C
C
      AMONT = B(KY3)
C
C
C
      DO 500 J=KY4,KY5
      B(J) = B(J)-ZER
      IB = B(J)
  500 IDENT = IDENT+IB*10**(J-KY4)
C
C
C
      IDSC = B(KY6)-ZER
      ICOD = B(KY7)-ZER
      ITSCL1 = B(KY8)-ZER
      ISCL1 = B(KY9)-ZER
      IPP = B(KY10)-ZER
C
C       IF THERE IS A DISAGREEMENT, WRITE A MESSAGE.
      IF (ISTAA.NE.ISTA) GO TO 520
      IF (IDENT.NE.IDEN) GO TO 520
      IF (IDSC.NE.IDSCL) GO TO 520
      IF (ICOD.NE.ICODE) GO TO 520
      IF (ITSCL1.NE.ITSCL) GO TO 520
      IF (ISCL1.NE.ISCL) GO TO 520
      IF (IPP.NE.IP) GO TO 520
  510 FORMAT (5X,'LABEL=510.   CARD INPUTS EQUALLED TAPE HEADER FOR
     1 STATION ',I3,A1/5X,'IDEPTH= ',I3/)
      WRITE (6,510) ISTA,AMONC,IDEN
      GO TO 540
  520 WRITE (6,530) ISTA,AMONC,IDEN,IDSCL,ICODE,ITSCL,ISCL,IP,ISTAA,AMON
     1T,IDENT,IDSC,ICOD,ITSCL1,ISCL1,IPP
  530 FORMAT (/3X'CARD AND TAPE DISAGREE, CARD ON TOP'/3X,'   ISTA  AMON
     1C IDENT   IDSCL  ICODE  ITSCL   ISCL     IP'/3X,I7,A7,6I7/3X,I7,
     2 A4,I10,5I7/)
C       WRITE THE RESULTS
  540 WRITE (6,550) ISTA,AMONC,IDEN
  550 FORMAT (5X,'LABEL 550.  HEADER PROCESSING COMPLETE EXCEPT SEARCH
     1  FOR ERRORS ON STATION ',I3,A1/5X,'IDEN= ',I3/)
C
C       CONSIDER IT POSSIBLE THAT NO IRG EXISTS AFTER THE HEADER.
C       THE PROGRAM HAS FILLED THE B ARRAY WITH BOTH THE HEADER AND
```

```
C       TEMPERATURE TRACE. ASSUME THERE IS A TRACER SYMBOL IN POS-
C       ITION 12. IF THIS IS SO, CONTINUE TO PROCESS THE B ARRAY.
      IF (B(KY11).NE.STAR) GO TO 570
      JJJJ = KY11
      WRITE (6,560)
  560 FORMAT (/5X,'NO IRG AFTER HEADER; CONTINUE TO PROCESS B ARRAY.'/)
      GO TO 330
  570 IF (IHDR.EQ.0) GO TO 1360
C
C       THIS BRANCH RETURNS TO 120 IF THE HEADER IS MISSING. SET IHDR=1
C       ON THE CARD.
      WRITE (6,580)
  580 FORMAT (/5X,'HEADER MISSING; INFO INSERTED WITH CARDS.'/)
      IHDR = 0
      GO TO 120
C
C       *****************************************************************
C***(2) PROCESS TRACE BY SUMMING X AND Y.******************************
C
C       THE FOLLOWING PROCEDURE PERMITS THE PRESENCE OF ANY REASONABLE
C       NUMBER OF TRACER SYMBOLS (STAR) INCLUDING NONE.
  590 NE = 0
      NF = 0
      NSTAR = 0
  600 IF (B(JJ).EQ.STAR) GO TO 620
C
C       COUNT STARS AND WRITE MESSAGE
      WRITE (6,610) NSTAR
  610 FORMAT (/5X,'START TRACER MODE; NO. OF TRACER SYMBOLS =',I2/)
C       WHEN THERE ARE NO MORE STARS, START TESTING FOR COUNT SYMBOLS ETC
      GO TO 630
  620 JJ = JJ+1
      NSTAR = NSTAR+1
C       CONTINUE TO TEST FOR STARS UNTIL NO MORE APPEAR.
      GO TO 600
C
C       THE NEXT BLOCK OF OPERATIONS TO JUST BEYOND 820 LOOPS BACK TO
C       630 CONTINUALLY, TESTING EACH CHARACTER FOR IDENTITY AND
C       CONTINUING TO ADD OR SUBTRACT FROM THE CUMULATIVE Y AND X COUNTS
C       UNTIL A DELETE-RECORD SYMBOL OR A STAR OR A DOLLAR INDICATES
C       THE END OF DATA. THE FLAG IS PLACED AT THE POINT WHERE THE TRACE
C       ACTUALLY BEGINS TO RECORD T VS D. PREVIOUS COUNTS RESULT
C       FROM THE TRACER TRAVELING FROM THE COORDINATE ORIGIN TO THIS
C       POINT.
  630 IF (B(JJ).EQ.ONE) GO TO 650
      IF (B(JJ).EQ.BLANK) GO TO 660
      IF (B(JJ).EQ.MINUS) GO TO 670
      IF (B(JJ).EQ.FLAG) GO TO 820
```

```
      IF (B(JJ).EQ.KEY) GO TO 390
C      THE NEXT GROUP OF STATEMENTS ALLOW FOR OCCASIONAL COUNTS GREATER
C      THAN + OR - 1.
      IF (B(JJ).EQ.TWO) GO TO 680
      IF (B(JJ).EQ.THREE) GO TO 690
      IF (B(JJ).EQ.FOUR) GO TO 700
      IF (B(JJ).EQ.FIVE) GO TO 710
      IF (B(JJ).EQ.SIX) GO TO 720
      IF (B(JJ).EQ.SEVEN) GO TO 730
      IF (B(JJ).EQ.EIGHT) GO TO 740
      IF (B(JJ).EQ.NINE) GO TO 750
      IF (B(JJ).EQ.TEN) GO TO 760
      IF (B(JJ).EQ.ELEVEN) GO TO 770
      IF (B(JJ).EQ.MTWO) GO TO 780
      IF (B(JJ).EQ.MTHREE) GO TO 790
      IF (B(JJ).EQ.MFOUR) GO TO 800
      IF (B(JJ).EQ.MFIVE) GO TO 810
      IF (B(JJ).EQ.DLTREC) GO TO 920
      WRITE (6,640) B(JJ)
  640 FORMAT (//5X,'SYMBOL NOT RECOGNIZED = ',Z8//)
C      WE ELIMINATE PRINTING OF THIS STATION AND INITIALIZE VARIABLES
C      IF IP ALSO IS EQUAL TO 1.
      IF (IP.EQ.1) GO TO 1330
      GO TO 1360
  650 RX = 1.
      GO TO 860
  660 RX = 0.
      GO TO 860
  670 RX = -1.
      GO TO 860
  680 RX = 2.
      GO TO 860
  690 RX = 3.
      GO TO 860
  700 RX = 4.
      GO TO 860
  710 RX = 5.
      GO TO 860
  720 RX = 6.
      GO TO 860
  730 RX = 7.
      GO TO 860
  740 RX = 8.
      GO TO 860
  750 RX = 9.
      GO TO 860
  760 RX = 10.
      GO TO 860
```

```
  770 RX = 11.
      GO TO 860
  780 RX = -2.
      GO TO 860
  790 RX = -3.
      GO TO 860
  800 RX = -4.
      GO TO 860
  810 RX = -5.
      GO TO 860
  820 JJJ = NE
      JJ = JJ+1
      FG = 1
      GO TO 630
C       CHECK HERE FOR MULTIPLE KEYBOARD SYMBOLS. IF NUMBER EXCEEDS
C       EIGHT TERMINATE THE PROGRAM. THE NUMBER EIGHT IS ARBITRARY.
C       SELDOM DOES ONE GET MORE THAN THREE KEYBOARD SYMBOLS ON THE TAPE
C       ACCIDENTALLY.
  830 WRITE (6,840)
  840 FORMAT (5X,'FOUND EIGHT KEYBOARD SYMBOLS IN SEQUENCE.  STOP.')
      GO TO 1360
  850 KL = KL+1
      JJ = JJ+1
      IF (KL.EQ.8) GO TO 830
      IF (B(JJ).EQ.STAR) GO TO 590
C       TRY AGAIN
      GO TO 390
C
C       THE ADDING IS DONE HERE AND THE CUMULATIVE SUM STORED, ONE
C       UNIT PER .01 INCH.
  860 N = N+1
      NE = N/2
      NF = NE*2
      IF (NF.EQ.N) GO TO 870
C       THIS FIDDLING AROUND DETERMINES IF  THE COUNT IS EVEN OR ODD.
C       START COUNTING IN THE ORDER YXYX (BECAUSE THE CHART IS READ
C       SIDEWAYS.  X AND Y IN THIS PROGRAM HAVE THE NORMAL ORIENTATIONS
C       ON THE STRIP CHART.  THEY ARE INVERTED WITH RESPECT TO THE
C       CALMA DIGITIZER. SPECIFICALLY DEPTH DECREASES ALONG THE
C       POSITIVE X AXIS AND TEMP INCREASES ALONG THE POSITIVE Y AXIS
C       ON THE CALMA DIGITIZER.
C
C       IF ODD
      SUMD = SUMD+RX
C       INCREASE THE ODD INDEX TO KEEP IT THE SAME AS THE EVEN.
      NE = NE+1
      Y(NE) = SUMD
      JJ = JJ+1
```

```
      GO TO 880
C
C      IF EVEN
  870 SUMT = SUMT+RX
      X(NE) = SUMT
      JJ = JJ+1
C      IF A STAR OR DOLLAR IS FOUND, THIS IS THE END OF THE DATA.
  880 IF (B(JJ).EQ.DLR) GO TO 940
C      END NORMAL TRACE PROCESSING
C
C      BEGIN TROUBLE SHOOTING
C      IF THERE IS NO IRG BETWEEN TRACES BUT THERE IS A TRACER SYMBOL,
C      THE TWO CAN BE SEPARATED BY FIRST SETTING
C      NOIRG=1, DOING NORMAL PROCESSING ON THE FIRST PART OF THE
C      B ARRAY, READING A NEW SET OF CARDS, AND THEN PROCESSING THE
C      SECOND PART OF B.
      IF (B(JJ).NE.STAR) GO TO 900
      NOIRG = 1
C      SAVE THE INDEX OF THE START OF THE SECOND HALF, JJJJ.
      JJJJ = JJ
      WRITE (6,890)
  890 FORMAT (/5X,'FOUND A STAR AT END OF TRACER ASSUME THERE IS NO IRG.
     1'/5X,'PROCESS RECORD IN TWO PARTS, READING CARDS FOR BOTH PARTS.'/
     2)
      GO TO 940
  900 IF (B(JJ).NE.KEY) GO TO 630
      JJJJ = JJ
      WRITE (6,910)
  910 FORMAT (/5X,'FOUND A KEYBOARD SYMBOL.  PROCESS NEXT PORTION OF B A
     1RRAY AFTER READING NEW CARDS.'/)
      NOIRG = 1
      GO TO 940
C
  920 WRITE (6,930) JJ
  930 FORMAT (5X,'FOUND DELETE RECORD SYMBOL AT JJ= ',I5)
C      IF DELETE RECORD IS FOUND, GO TO 470  AND INCREMENT THE
C      VARIABLE, IT, BUT RETURN TO STATEMENT 170. A NEW SET OF CARDS
C      IS NOT READ BUT THE RECORD COUNT, IT, IS INCREMENTED.
      GO TO 470
  940 JJ = JJ-1
C
C      END TRACER AND ASSOCIATED TROUBLE SHOOTING
C
C      ****************************************************************
C***(J) CONVERT X AND Y ARRAYS TO DEPTH AND TEMPERATURE.****************
C
      WRITE (6,950) JJJ,NE,Y(NE),X(NE)
  950 FORMAT (/5X,'LABEL 950.  START CONDENSING UNCONVERTED ARRAY AND CO
```

```
     1NVERTING TO SCIENTIFIC UNITS.'/5X,'THE TRACER ENTERED THE FRAME (F
     2LAG) AT JJJ= ',I5/5X,'THE END OF THE TRACE HAS INDEX NE= ',I5/
     3 5X,'LAST (UNCONVERTED) DEPTH AND TEMP ARE: ',F7.1,2X,F7.1/)
C
C
C        CHECK TO SEE IF FLAG WAS FOUND.
      IF (FG.EQ.1) GO TO 970
      WRITE (6,960)
  960 FORMAT (/5X,'NO FLAG FOUND; PROCESS ANYWAY.'/)
  970 WRITE (6,980)
  980 FCRMAT (' ')
      FG = 0
C
C        THE X AND Y ARRAYS ARE FILLED AND THE START AND END OF THIS BATCH
C        OF DATA ARE LABELED WITH JJJ AND NE. THE ARRAYS ARE INDEXED
C        ON  0.01 INCH DEPTH SPACING. SUBROUTINE CONDNS INTERPOLATES TO
C        FILL ANY BLANK ARRAY POSITIONS.
      CALL CONDNS (X,Y,T,JJJ,NE,KDTH1,KDTH2)
C
C
C
      DO 1060 J=KDTH1,KDTH2
      D(J) = (J-1)/DCON(IDSCL)+DCOR
C        SUBROUTINE WLQP2, LOCATED IN THE SUBROUTINE LIBRARY OF THE W. R.
C        CHURCH COMPUTER CENTER WAS USED TO DETERMINE THE COEFFICIENTS
C        FOR A BEST FIT SECOND DEGREE POLYNOMIAL THAT DESCRIBED THE
C        RELATIONSHIP BETWEEN THE TEMP AND THE MOVEMENT OF THE STYLUS
C        AS MEASURED IN HUNDREDS OF INCHES.
C        A SINGLE POLYNOMIAL DID NOT ACCURATELY DESCRIBE
C        THIS RELATIONSHIP. IT WAS NECESSARY TO BREAK THE TRACE INTO
C        FIVE SEGMENTS. THE FIRST EQUATION WAS DETERMINED FOR TEMPS FROM
C        1 TO 5 DEG., THE NEXT EQUATION FROM 5 TO 10 DEG., ETC, UP TO A
C        MAXIMUM OF 25 DEG. BY USING SEGMENTS THE EQUATIONS ARE ACCURATE
C        TO WITHIN AT LEAST 0.01 DEG.
C
C        TCOR IS A TEMP CORRECTION WHICH MAY BE APPLIED TO A SINGLE
C        STATION IF NECESSARY. A SINGLE STATION MAY BE IN ERROR DUE
C        TC IMPROPER DIGITIZING TECHNIC. IF THE OPERATOR STARTS TO
C        TRACE AT A POINT WHICH IS NOT THE ORIGIN A CONSTANT CORR. CAN
C        SHIFT THE TRACE BACK TO THE ORIGIN.
C        XBTCOR IS A CORRECTION DESIGNED TO MAKE THE XBT READING
C        AGREE WITH A STANDARD, EITHER WITH A NANSEN CAST OR A
C        STANDARDIZED STD TRACE WHICH WAS MADE AT THE SAME TIME.
C        GENERALLY THE XBT TEMP WAS NOTICABLY HIGHER THAN THE TEMPS
C        RECORDED BY THE OTHER TWO METHODS. THIS CORRECTION ENABLES ONE TO
C        CCMPARE TEMPS TAKEN BY DIFFERENT METHODS.
C
       IF (T(J).LT.16.6) WRITE (6,990)
```

```
  990 FORMAT (/5X,'T(J) LESS THEN 1.0 DEG')
      IF (T(J).LT.16.6) GO TO 1060
      IF (T(J).GT.88.2) GO TO 1000
      T(J) = .0509421+.057236*T(J)-.0000125*T(J)*T(J)+TCOR+XBTCOR
      GO TO 1060
 1000 IF (T(J).GT.182.8) GO TO 1010
      T(J) = .179875+.0556283*T(J)-.0000104*T(J)*T(J)+TCOR+XBTCOR
      GO TO 1060
 1010 IF (T(J).GT.280.2) GO TO 1020
      T(J) = .520519+.0522706*T(J)-.0000021*T(J)*T(J)+TCOR+XBTCOR
      GO TO 1060
 1020 IF (T(J).GT.378.8) GO TO 1030
      T(J) = 2.18667+.042103*T(J)+.0000129*T(J)*T(J)+TCOR+XBTCOR
      GO TO 1060
 1030 IF (T(J).GT.475.6) GO TO 1040
      T(J) = 2.55982+.0415735*T(J)+.0000118*T(J)*T(J)+TCOR+XBTCOR
      GO TO 1060
 1040 IF (T(J).GT.475.6) WRITE (6,1050)
 1050 FORMAT (/5X,' T(J) EXCEEDS 25 DEG.')
 1060 CONTINUE
C
C
C
C      ***************************************************************
C***(K) MANUALLY INSERT SURFACE AND NEAR SURFACE VALUES.****************
C
C       THE T ARRAY IS NOW CONVERTED, AND IT IS NOW NECESSARY
C       TO REINSERT SURFACE AND NEAR SURFACE DATA.  NORMALLY, ONLY
C       SURFACE VALUES  NEED TO BE INSERTED DUE TO THE DIGITIZER OPERATOR
C       BEGINNING HIS TRACING SLIGHTLY BELOW HIS ZERO DEPTH REFERENCE.
C       SURFACE VALUES ARE INSERTED BY CHECKING THE VALUE OF IH.
C       IF IH EQUALS ZERO, NO DATA IS INSERTED MANUALLY. IF IH=1,SURFACE
C       DEPTH AND TEMPERATURE ARE INSERTED VIA &DAT DATA CARD FOR THE
C       PARTICULAR STATION. THIS HAND ENTERED DATA IS STORED IN THE
C       DH AND TH ARRAYS. INFREQUENTLY IT MAY BE NECESSARY TO MANUALLY
C       INSERT DATA VALUES FOR DEPTHS AT NEAR SURFACE.
C       THIS IS AGAIN NECESSARY ONLY IF THE
C       DIGITIZER OPERATOR BEGAN DIGITIZING WELL BELOW THE ZERO DEPTH
C       REFERENCE. SINCE THIS OCCURS INFREQUENTLY AND INVOLVES A SIGNIF-
C       ICANT AMOUNT OF WORK TO MANUALLY INSERT THE DATA VIA CARDS, THIS
C       CPERATION IS PERFORMED ONLY WHEN WRITING THE COMPOSITE TAPE AND
C       CONSEQUENTLY ONLY WHEN ISQZ=1.THUS TO INSERT NEAR SURFACE DATA
C       IHMUSTBEGREATERTHANOREQUALTO2ANDISQZ=1.DHANDTHARE
C       DIMENSIONED AT 12 , WHICH EQUATES TO APPROXIMATELY 10.5 METERS AT
C       ISQZ=1.  ISQZ=1 WAS CHOSEN BECAUSE ALL OF THE ELEMENTS OF THE D,T
C       ARRAYS ARE PRINTED AS OUTPUT VIA OUT2. THIS ELIMINATES "GUESSWORK
C       WITH RESPECT TO WHICH VALUES NEED TO BE INSERTED, SINCE ALL
C       VALUES ARE INSERTED.  IF THERE IS A GAP BETWEEN HAND ENTERED
```

```
C       CATA AND XBT DATA , IT IS NOT FILLED.
C
      IF (IH.EQ.0) GO TO 1080
      T(1) = TH(1)
      IF (IH.LT.2) GO TO 1080
      IF (ISQZ.GT.1) GO TO 1080
C
C
C
      DO 1070 J=2,IH
      D(J) = DH(J)
      T(J) = TH(J)
 1070 CONTINUE
C
C
C
 1080 CONTINUE
C
C     DIAGNOSTIC WRITE STATEMENTS FOLLOW:
C-------------------
      IPLACE = 1080
      WRITE (6,180) (D(J),J=1,1801,20),IPLACE
      WRITE (6,180) (T(J),J=1,1801,20),IPLACE
      WRITE (6,190) JJJ,NE,KDTH1,KDTH2,JJJJ
C-------------------
C
C       ***************************************************************
C***(L) ELIMINATE UNWANTED DATA.****************************************
C
C       IN DIGITIZING TEMP SEGMENTS ONE FREQUENTLY GETS UNUSUAL VALUES
C       AT THE TOP OR BOTTOM OF THE TRACE SEGMENT (ZERO OR VERY HIGH). IT
C       IS DESIRABLE THAT THESE UNWANTED VALUES BE ELIMINATED PRIOR TO
C       WRITING A TAPE OR PUNCHING CARDS. THUS A CHECK IS MADE TO SEE
C       IF T(J) IS ZERO OR GREATER THAN 25.
C
C       THESE VALUES ARE WRITTEN OUT
C       AND COUNTED FOR RECORD PURPOSES BUT ARE DISCARDED FROM THE
C       C AND T ARRAYS. NOTE THE VALUE OF KDTH2, WHICH IS EQUAL TO THE
C       TOTAL NUMBER OF RECORDS, IS REDUCED BY THE NUMBER OF UNWANTED
C       RECORDS.
      K = 0
      L = 1
C
C
C
      DC 1110 J=1,KDTH2
      IF ((T(J).EQ.0.0).OR.(T(J).GT.25.0)) GO TO 1090
      D(L) = D(J)
```

```
      T(L) = T(J)
      L = L+1
      GO TO 1110
 1090 WRITE (6,1100) D(J),T(J),J
      K = K+1
      JSAV = K
 1100 FORMAT (//5X,2F7.2,I6,//)
 1110 CONTINUE
C
C
C
 1120 FORMAT (//5X,' JSAV=',I6,//)
      WRITE (6,1120) JSAV
      KDTH2 = KDTH2-JSAV
C
C       ************************************************************
C***(M) GENERATE SERIAL NUMBERS FOR TAPE OUTPUT.************************
C
C       GENERATE SERIAL NUMBERS FOR THE RECORDS. A RECORD IS
C       EITHER A HEADER FOR A STATION OR THE VALUES  (D AND T) FOR
C       A SINGLE DEPTH.
C
C
C
C
      DC 1130 J=1,KDTH2
      JREC = JREC+1
      IREC(J) = JREC
 1130 CCNTINUE
C
C
C
C       ************************************************************
C***(N) CONVERT LETTER CODE TO MONTH/YEAR.***************************
C
C       THIS SECTION CONVERTS THE LETTER DESIGNATOR FOR MONTH (AMONC)
C       FROM THE SINGLE LETTER CODE ON THE DIGITIZED TAPE TO THE
C       APPROPRIATE MONTH AND YEAR IN PREPARATION FOR WRITING THE OUTPUT.
C
C
C
      DC 1140 J=1,13
      IF (AMONC.EQ.AMONCA(J)) GO TO 1160
 1140 CONTINUE
C
C
C
 1150 FORMAT (15X,'AMONC NEVER DID EQUAL AMONC(J) CONSEQUENTLY,
     1 WMONTH WILL NOT BE DEFINED'/)
```

```
      WRITE (6,1150)
      GO TO 1170
 1160 WMONTH = EVENT(J)
 1170 CCNTINUE
C
C      **************************************************************
C***(O) OUTPUT.******************************************************
C
C       PRINT DATA
C
C       THE PARAMETER ISQZ PERMITS CONDENSING THE PRINTED DATA BY THE
C       FACTOR ISQZ
C
      IF (.NOT.PRT1) GO TO 1190
C
      WRITE (6,1180)
 1180 FCRMAT ('1')
      CALL OUT2 (D,T,KDTH2,ISTA,WMONTH,IREC,JREC,ISQZ)
C
C       WRITE TAPE
C
C       TAPE MUST BE TRUE ONLY ONCE, AT THE BEGINNING OF TAPE  WRITING.
C       THE PROGRAM EXPECTS JCL TO WRITE CARD IMAGES ON THE TAPE
C       IN RECORDS 20 DIGITS LONG.
 1190 IF (.NOT.TAPE) GO TO 1230
C       WRITE THE HEADER INFO HERE.
      WRITE (8,1200) ISTA,WMONTH,KDTH2
 1200 FORMAT (I4,A9,I6)
      WRITE (8,1210) (D(J),T(J),J=1,KDTH2)
 1210 FORMAT (F8.2,F6.2)
      WRITE (6,1220) ISTA,WMONTH,JREC
 1220 FORMAT (5X,'DATA FOR STATION ',I5,A12,' WRITTEN ON TAPE UP TO
     1  RECORD ',I6)
C
C       FUNCH CARDS
C
C       COMPRESS THE PUNCHED DATA BY A FACTOR ICSQZ. FORMAT FOR FOUR
C       DATA SETS ON A CARD. NPTS  BECOMES THE NUMBER OF DATA PRINTED
C       IF IT IS EVENLY DIVISIBLE. GTHERWISE THE LAST DATUM IS ALSO
C       PUNCHED. SUPPLY JCL FOR CARD PUNCHING.
C
 1230 IF (.NOT.CARDS) GO TO 1330
C
C       THE NUMBER OF POINTS TO BE RETAINED AFTER CONDENSATION IS
C       1+(N-1)/ISQZ. IF THIS DOES NOT COME OUT INTEGRAL ADD THE LAST
C       FOINTS.
      NPTS = (KDTH2-1)/ICSQZ
      NPT1 = KDTH2-1-ICSQZ*NPTS
```

```
      NPTS = NPTS+1
C      WRITE A HEADER CARD
 1240 FORMAT (14X,'OCEANOGRAPHIC DATA FROM U C M II',//)
 1250 FORMAT (1X,I4,' VALUES OF D,T FOR XBT STA.',I3,A8,'COMPRESSED BY',
     1 I3,/)
 1260 FORMAT (4X,'DEPTH',2X,'TEMP.',2X,'DEPTH',2X,'TEMP.',2X,'DEPTH',
     1 2X,'TEMP.',2X,'DEPTH',2X,'TEMP.')
 1270 FORMAT (4X,'METERS',1X,'DEG.C.',1X,'METERS',1X,'DEG.C.',1X,'METERS
     1',1X,'DEG.C.',1X,'METERS',1X,'DEG.C.',/)
      WRITE (7,1240)
      WRITE (7,1250) NPTS,ISTA,WMONTH,ICSQZ
      WRITE (7,1260)
      WRITE (7,1270)
C      NOW FIND THE NUMBER OF CARDS
      NCARDS = NPTS/4
      NCRD1 = NPTS-4*NCARDS
C      THERE WILL BE ONE MORE CARD IF NCRD1.NE.0.
      INCR = 4*ICSQZ
      J = 1-INCR
      K = 0
 1280 J = J+INCR
      K = K+1
      J1 = J+ICSQZ
      J2 = J1+ICSQZ
      J3 = J2+ICSQZ
 1290 FORMAT (2X,4(F8.2,F6.2),3X,I3,A10,I6)
      WRITE (7,1290) D(J),T(J),D(J1),T(J1),D(J2),T(J2),D(J3),T(J3),ISTA,
     1WMONTH,JREC
      IF (K.LT.NCARDS) GO TO 1280
      IF (NCRD1.EQ.0) GO TO 1320
C      WRITE THE LAST CARD
      J = J3+ICSQZ
      WRITE (7,1290) D(J),T(J)
      IF (J.EQ.KDTH2) GO TO 1320
      J = J+ICSQZ
 1300 FORMAT (1H+,16X,F8.2,F6.2)
      WRITE (7,1300) D(J),T(J)
      IF (J.EQ.KDTH2) GO TO 1320
      J = J+ICSQZ
 1310 FORMAT (1H+,30X,F8.2,F6.2)
      WRITE (7,1310) D(J),T(J)
 1320 CONTINUE
C
 1330 IF (ENDFL) END FILE 8
C      ENDFL MUST BE TRUE ONCE ON THE LAST TAPE WRITING OPERATION.
C
C      ***************************************************************
C***(P) INITIALIZE VARIABLES FOR NEXT STATION.**************************
```

```
    1 2X,'TEMP.',2X,'DEPTH',2X,'TEMP.')
   50 FORMAT (4X,'METERS',1X,'DEG.C.',1X,'METERS',1X,'DEG.C.',1X,'METERS
     1',1X,'DEG.C.',1X,'METERS',1X,'DEG.C.',/)
      NPTS = NPTS+1
      INCR = 4*ISQZ
      NPTS = (KDTH2-1)/ISQZ
      WRITE (6,20)
      WRITE (6,30) NPTS,ISTA,WMONTH,ISQZ
      WRITE (6,40)
      WRITE (6,50)
C       COMPUTE NUMBER OF FULL LINES
      NLNS = (KDTH2-1+ISQZ)/INCR
      NLN1 = KDTH2-1-(4*NLNS-1)*ISQZ
      J = 1-INCR
      K = 0
   60 J = J+INCR
      K = K+1
      J1 = J+ISQZ
      J2 = J1+ISQZ
      J3 = J2+ISQZ
   70 FORMAT (2X,4(F8.2,F6.2),10X,2I6)
      WRITE (6,70) D(J),T(J),D(J1),T(J1),D(J2),T(J2),D(J3),T(J3),IREC(J)
     1,IREC(J3)
      IF (K.LT.NLNS) GO TO 60
C
      IF (NLN1.EQ.0) GO TO 120
C       WRITE THE LAST LINE
      J = J3+ISQZ
      WRITE (6,70) D(J),T(J)
      IF (J.EQ.KDTH2) GO TO 110
      J = J+ISQZ
   80 FORMAT (1H+,15X,F8.2,F6.2)
      WRITE (6,80) D(J),T(J)
      IF (J.EQ.KDTH2) GO TO 110
      J = J+ISQZ
   90 FORMAT (1H+,29X,F8.2,F6.2)
      WRITE (6,90) D(J),T(J)
  100 FORMAT (1H+,73X,I6)
  110 WRITE (6,100) IREC(J)
  120 CONTINUE
C
C       COUNT RECORDS
  130 FORMAT (//5X,'THIS STATION CONTAINS RECORDS ',I5,' TO ',I5,' INCLU
     1SIVE. '/)
      WRITE (6,130) IREC(1),JREC
  140 FORMAT (1H1)
      WRITE (6,140)
      RETURN
```

```
C
      JREC = JREC+1
C
C
C
      DO 1340 J=1,1801
      D(J) = 0.
      T(J) = 0.
 1340 CONTINUE
C
C
C
C
      DO 1350 J=1,12
      TH(J) = 0.
      DH(J) = 0.
 1350 CONTINUE
C
C
C
      SKIP = .FALSE.
      ICEN = 0
      IH = 0
      IP = 0
      JSAV = 0
      IF (NOIRG.EQ.1) GO TO 330
C
 1360 IT = IT+1
      GO TO 120
 1370 STOP
      END
```

```
C        ---------------SUBROUTINE OUT2 ------------------
C        THIS OUTPUT SUBROUTINE FOR DIGIXBT PRINTS DEPTHS AND TEMPS
C        FOUR COLUMNS TO A PAGE.
C
      SUBROUTINE OUT2 (D,T,KDTH2,ISTA,WMONTH,IREC,JREC,ISQZ)
      REAL *8WMONTH
      DIMENSION D(1801), T(1801), IREC(1801)
C       PRODUCE HEADING
   20 FORMAT (14X,'OCEANOGRAPHIC DATA FROM U C M II',//)
   30 FORMAT (1X,I4,' VALUES OF D,T FOR XBT STA.',I3,A8,'COMPRESSED BY',
     1 I3,/)
   40 FORMAT (4X,'DEPTH',2X,'TEMP.',2X,'DEPTH',2X,'TEMP.',2X,'DEPTH',
```

```
      END
C      ------------------------SUBROUTINE CONDNS---------------------
C      THIS SUBROUTINE FINDS THE ARRAY LOCATIONS FOR X, INDEXED
C      SEQUENTIALLY FOR EACH UNIT OF Y.  EACH UNIT OF Y IS 1.0 AND
C      CORRESPONDS TO .01 INCHES OF TRAVEL IN THE DEPTH DIRECTION.
C
      SUBROUTINE CONDNS (X,Y,T,JJJ,NE,KDTH1,KDTH2)
      DIMENSION X(1), Y(1), T(1), KINS(10), KNO(10)
C      IF FIRST INDEX IS ZERO OR NEGATIVE THERE IS A MISBEHAVIOR ELSE-
C      WHERE IN THE PROGRAM.  RESET JJJ TO 1.
      IF (JJJ.GE.1) GO TO 30
      JJJ = 1
      WRITE (6,20)
   20 FORMAT (/5X,'****** JJJ RESET TO ONE - SOMETHING WRONG ******'/)
C      KDTH1 BECOMES THE INDEX OF THE START OF THIS ARRAY SEGMENT.
   30 KDTH1 = Y(JJJ)+1.50
C      BUT IN CASE KDTH1 BECOMES ZERO OR LESS, USE THE START OF THE
C      CURVE AS THE ORIGIN OF INDEXING.
C      THIS CAUSES AN OVERLAP BETWEEN ARRAYS, BUT IT SHOULD BE SMALL.
      XINC = 0.
      IF (KDTH1.GT.0) GO TO 40
      XINC = FLOAT(1-KDTH1)
      KDTH1 = 1
C
   40 JJ1 = JJJ+1
      NE1 = NE-1
C      FORM SUBSCRIPTS FROM THE DEPTH INCREMENTS AND STORE X'S AT THOSE
C      ARRAY LOCATIONS.
C      SEARCH FOR BLANKS IN ARRAY BETWEEN INDEXES KDTH1 AND KDTH2.
C      KCT COUNTS THE NUMBER OF BLANKS
      KCT = 0
      KSAV = KDTH1
C      KINS(J) IS THE NUMBER OF THE ARRAY POSITION FILLED.
C
C
C
      DO 50 J=1,10
      KNO(J) = 0
   50 KINS(J) = 0
C
C
C
C
```

```
      DO 80 J=JJ1,NE1
      KDTH = Y(J)+1.50+XINC
      T(KDTH) = X(J)
C      TEST TO SEE IF INDEX IS THE SAME OR ONE GREATER THAN THE LAST
C      ONE.  IF NOT, INTERPOLATE VALUES.
      NREP = KDTH-KSAV
      IF (NREP.LE.1) GO TO 70
      KCT = KCT+1
      IF (KCT.GT.10) KCT = 10
      KNO(KCT) = NREP
      KINS(KCT) = KDTH
      II = KSAV+1
      III = KDTH-1
      E = FLOAT(NREP)
      G = T(KDTH)
      F = G-T(KSAV)
C
C
C
      DO 60 I=II,III
   60 T(I) = (FLOAT(I-KSAV)/E)*F+G
C
C
C
   70 KSAV = KDTH
   80 CONTINUE
C
C
C
      KDTH2 = Y(NE)+1.50+XINC
C      PUT IN THE FIRST POINT, WHICH OTHERWISE WOULD BE THE LAST
C      ONE FOR WHICH Y(J).LT.1.
      T(KDTH1) = X(JJJ)
      T(KDTH2) = X(NE)
C      SAVE INDEX OF END OF ARRAY.
C
C      WRITE DOWN NUMBER AND LOCATIONS OF INTERPOLATED VALUES.
      WRITE (6,90) KCT,(KINS(I),I=1,KCT),(KNO(I),I=1,KCT)
   90 FORMAT (/5X,'BLANK ARRAY POSITIONS FILLED IN ',I3,' PLACES.  BEGIN
     1NING INDEXES AND NO. OF STEPS'/5X,'(10 EACH) ARE: ',5X,10I6/
     2 5X,10I6/)
      RETURN
      END
```

```
C       ---------------SUBROUTINE CHMOVE -------------------------------------
        SUBROUTINE CHMOVE (A,I,B,J)
C        THIS SUBROUTINE RETURNS A LOGICAL*1 VARIABLE TO A 4-BYTE ADDRESS
C        IN THE MAIN PROGRAM, UNPACKING THE ORIGINAL 4-BYTE WORDS A
C        BYTE AT A TIME.
        LOGICAL *1A(1),B(1)
        B(J) = A(I)
        RETURN
        END
```

```
*       ...................................................................
*
           MACRO
           REGS
           LCLA   &N
           LCLC   &SYM
.LOCP      ANOP
&SYM       SETC   '&N'
R&SYM      EQU    &SYM
&N         SETA   &N+1
           AIF    (&N LT 16).LOOP
           MEND
           SPACE 2
TPRD      CSECT
           SPACE 2
           REGS
           SPACE 2
           STM    R14,R12,12(R13)
           LR   R12,R15
           USING TPRD,R12
           LA     R11,SAV1       LINK  SAVE REGISTERS
           ST     R13,4(R11)
           ST     R11,8(R13)
           LR     R13,R11
           LR     R11,R1          GET ADDRESS OF ARGUMENT LIST
           USING ARGS,R11
           L      R10,AADD
           ST     R10,SHOVAAD     PUT IN LIST FOR SHOVE CALL
           L      R10,ALADD
           L      R10,0(R10)      PUT LENGTH IN SAME LIST
           ST     R10,SHOVALN
           LA     R10,TPDCB
           USING IHADCB,R10
           TM     DCBOFLGS,X'10' HAS DCB BEEN OPENED?
```

```
         BO    OOKK          YES                                           TPR01640
         TM    BADBOMB,X'AA'  HAS THERE BEEN PREVIOUS CATASTROPHE?         TPR01650
         BNO   ONWITHIT       NOPE, GO AND OPEN IT                         TPR01660
         SPACE 2                                                           TPR01670
KIKIT    ABEND 3,DUMP         SHOULDNT EVER GET HERE, CRASH                TPR01680
         SPACE 2                                                           TPR01690
ONWITHIT OPEN  (TPDCB,INPUT)                                               TPR01700
         TM    DCBOFLGS,X'10' DID STUPID THING OBEY?                       TPR01710
         BNO   KIKIT           NOPE, GO PUNT                               TPR01720
         L     R9,DCBDEBAD    GET POINTER AND DEVICE STATISTICS TABLE      TPR01730
         L     R9,32(R9)       GET UCB ADDR OUT OF DEB                     TPR01740
         SR    R6,R6                                                       TPR01750
         IC    R6,9(R9)       GET STAT TABLE POINTER                       TPR01760
         MH    R6,=H'10'      POINTER * 10                                 TPR01770
         L     R9,16          POINTER TO CVT                               TPR01780
         L     R9,112(R9)     POINTER TO STAT TABLE START                  TPR01790
         LA    R9,0(R6,R9)     GOTCHA STAT TABLE                           TPR01800
         ST    R9,STATTAB     SAVE ADDRESS OF STAT TABLE                   TPR01810
         MVC   OLDSTAT,0(R9)   SAVE ITS INFO                               TPR01820
         SPACE 2                                                           TPR01830
OOKK     L     R0,SHOVALN  GET BLKSIZE FOR TAPE EXCP BUFFER                TPR01840
         STH   R0,BYTCNT      PUT DATA LENGTH INTC CCW                     TPR01850
         L     R1,SHOVAAD                                                  TPR01860
         ST    R1,TPBUFLOC                                                 TPR01870
         MVC   TPBLOC,TPBUFLOC+1  PUT BUFFER LOC IN CCW                    TPR01880
         LTR   R0,R0                                                       TPR01890
         BP    OOKKK                                                       TPR01900
         MVI   TPCCW,X'37'                                                 TPR01910
         BAL   R9,TPGET                                                    TPR01920
         MVI   TPCCW,X'02'                                                 TPR01930
         BAL   R9,TPWAIT                                                   TPR01940
         B     RETURN                                                      TPR01950
         SPACE 2                                                           TPR01960
         SPACE 2                                                           TPR01970
OOKKK    BAL   R9,TPGET       GO READ A BUFFER                             TPR01980
         SPACE 2                                                           TPR01990
         BAL  R9,TPWAIT       GO WAIT TILL READ FINISHED                   TPR02000
RETURN   LA    R15,0          NORMAL RETURN, MODIFIED ELSEWHERE            TPR02010
         L     R13,4(R13)     RESTORE REGISTERS                            TPR02020
         L     R14,12(R13)                                                 TPR02030
         LM    R0,R12,20(R13)                                              TPR02040
         BR    R14            ALL RETURNS THRU HERE                        TPR02050
         SPACE 2                                                           TPR02060
TPEOF    MVI   RETURN+3,X'04'  SET EOF RETURN                              TPR02070
         SPACE 2                                                           TPR02080
OUT      CLOSE TPDCB                                                       TPR02090
         SPACE 2                                                           TPR02100
         MVI   BADBOMB,X'AA'  TURN ON FLAG                                 TPR02110
```

```
         B     RETURN                                                   TPR02120
         SPACE 2                                                        TPR02130
GETSTAT  L     R9,STATTAB       ARRIVE HERE ON BAD READ                 TPR02140
         MVC   NEWSTAT,0(R9)     GET CURRENT STAT TABLE                 TPR02150
         L     R9,SHOVAAD       MOVE OLD AND NEW STAT TABLES TO FTN     TPR02160
         MVC   0(16,R9),OLDSTAT    ARRAY BEFORE ERROR RETURN            TPR02170
         MVI   RETURN+3,X'08'    SET I/O ERROR RETURN                   TPR02180
         B     OUT                                                      TPR02190
         SPACE 2                                                        TPR02200
TPGET    MVI   TPECB,X'00'      CLEAR ECB                               TPR02210
         MVC   TPEXCP,TPCCW                                             TPR02220
         MVI   RDFLG,X'FF'      TURN ON READ FLAG                       TPR02230
         EXCP  TPIOB            DO IT                                   TPR02240
         BR    R9               RETURN                                  TPR02250
         SPACE 2                                                        TPR02260
TPWAIT   TM    TPECB,X'40'      IS IT ALREADY DONE?                     TPR02270
         BO    NOWAIT           YES                                     TPR02280
         WAIT  ECB=TPECB        NO,WAIT FOR IT                          TPR02290
NOWAIT   CLI   TPECB,X'7F'      DID IT DO IT OK?                        TPR02300
         BE    OK1              YES,CONTINUE                            TPR02310
         SPACE 2                                                        TPR02320
         CLI   TPCSW+3,X'OD' PROBABLE EOF IF CHAN-DEV END & UNIT EXCPT  TPR02330
         BNE   GETSTAT       NOPE, GO FIND ERROR                        TPR02340
         CLI   FLAGS1,X'04'   EXCEPTIONAL CONDIT BIT ON? (=EOF)         TPR02350
         BNE   GETSTAT       NO EOF                                     TPR02360
         L     R1,DCBBLKCT    DECREMENT  DCBBLKCT SO IT MATCHES TAPE    TPR02370
         BCTR  R1,0                  TRAILER LABELS                     TPR02380
         ST    R1,DCBBLKCT                                              TPR02390
         EOV   TPDCB         YES,EOF - FORCE CONTROL TO EODAD RTN       TPR02400
         SPACE 2                                                        TPR02410
OK1      BR    R9                RETURN                                 TPR02420
         SPACE 2                                                        TPR02430
SAV1     DC    18F'0'                                                   TPR02440
         SPACE 2                                                        TPR02450
OLDSTAT  DC    D'0'             COPY OF STAT TABLE AFTER OPEN           TPR02460
NEWSTAT  DC    D'0'             COPY OF STAT TABLE UPON ERROR           TPR02470
         SPACE 2                                                        TPR02480
TPEXCP   DC    D'0'            LOC CONTAINING CCW BEING USED            TPR02490
TPCCW    DC    X'02'            READ                                    TPR02500
TPBLOC   DC    AL3(0)           DATA ADDRESS                            TPR02510
FLGS     DC    X'20'            SUPPRESS INCORRECT LNGT                 TPR02520
BYTCNT   DC    H'0'             BYTE COUNT                              TPR02530
         SPACE 2                                                        TPR02540
SHOVSMF  DC    A(0)             LOC OF SMF INFO                         TPR02550
SHOVAAD  DC    A(0)             ADDR OF FORTRAN ARRAY                   TPR02560
SHOVALN  DC    F'0'             BYTE LENGTH OF FORTRAN ARRAY            TPR02570
         SPACE 2                                                        TPR02580
TPBUFLOC DC    A(0)             LOC OF DCBBLKSI LENGTH TAPE BUFFER      TPR02590
```

```
         SPACE 2                                                        TPR02600
STATTAB  DC    A(0)            LOC OF STAT TABLE                        TPR02610
         SPACE 2                                                        TPR02620
         SPACE 2                                                        TPR02630
RDFLG    DC    X'00'            =X'FF' AFTER READ, BEFORE WAIT          TPR02640
BADBOMB  DC    X'00'           FLAG TO TELL WHETHER DCB USED BEFORE     TPR02650
         SPACE 2                                                        TPR02660
TPDCB    DCB   DDNAME=METTAP,MACRF=(E),EODAD=TPEOF,DSORG=PS,           *TPR02670
               IOBAD=TPIOB,DEVD=TA                                      TPR02680
         SPACE 2                                                        TPR02690
         DS    0F                                                       TPR02700
TPIOB    DS    0CL32                                                    TPR02710
FLAGS1   DC    X'00'                                                    TPR02720
FALGS2   DC    X'00'                                                    TPR02730
SENSE1   DC    X'00'                                                    TPR02740
SENS2   DC    X'00'                                                     TPR02750
ECBCOD   DC    X'00'                                                    TPR02760
ECBADD   DC    AL3(TPECB)                                               TPR02770
FALGS3   DC    X'00'                                                    TPR02780
TPCSW   DC    7X'00'                                                    TPR02790
SIOCODE  DC    X'00'                                                    TPR02800
EXCPADD  DC    AL3(TPEXCP)                                              TPR02810
RESERC   DC    X'00'                                                    TPR02820
DCBADDR  DC    AL3(TPDCB)                                               TPR02830
REPOMOD  DC    X'00'                                                    TPR02840
RESTADR  DC    AL3(0)                                                   TPR02850
BLCINC  DC    H'1'                                                      TPR02860
ERORCNT  DC    H'0'                                                     TPR02870
         SPACE 2                                                        TPR02880
TPECB    DC    F'0'                                                     TPR02890
         SPACE 2                                                        TPR02900
ARGS     DSECT                                                          TPR02910
AADD     DC    A(0)            ADDRESS OF FORTRAN ARRAY                 TPR02920
ALADD    DC    A(0)            ADDRESS OF LENGTH OF FORTRAN ARRAY       TPR02930
         SPACE 2                                                        TPR02940
         PRINT NOGEN                                                    TPR02950
         DCBD  DSORG=PS,DEVD=TA                                         TPR02960
         PRINT GEN                                                      TPR02970
         SPACE 2                                                        TPR02980
TPRD    CSECT                                                           TPR02990
         LTORG                                                          TPR03000
         END                                                            TPR03010
```

APPENDIX F

```
C TITLE           XBTPLT
C
C PRCGRAMER       R.E.BLUMBERG
C
C DOCUMENTATION   R.E.BLUMBERG
C
C DATE            12 AUGUST 1975
C
C PURPOSE         XBTPLT IS COMPATIBLE WITH THE FORMAT WRITTEN ON THE 9-
C                  TRACK TAPE BY DIGIXBT. THIS PROGRAM READS DEPTH AND
C                  TEMP DATA FROM THE 9-TRACK TAPE, AND RETAINS THE TEMP,
C                  DEPTH AND STATION NUMBER OF THOSE STATIONS WITH
C                  SUFFICIENT SPECIFIED DEPTH AND WITH THE DESIRED
C                  LOCATION WHICH ARE TO BE PLOTTED. XBTPLT USES
C                  SUBROUTINE CONTUR FROM THE W.R. CHURCH COMPUTER CENTER
C                  SUBROUTINE LIBRARY.
C ARGUMENTS       SEE THE SUBROUTINE LIBRARY FOR A DESCRIPTION OF THE
C                  VARIABLES USED IN THE SUBROUTINE CONTUR. THE FOLLOWING
C                  IS A BRIEF DESCRIPTION OF THE IMPORTANT ARRAYS AND
C                  VARIABLES:
C                  AM    - THE PLOTTING ARRAY USED IN CONTUR
C                  IFILE- NUMBER OF FILES DESIRED TO BE READ FROM TAPE.
C                  ISTA - ARRAY OF STATION NUMBERS READ AND RETAINED  FOR
C                   PLOTTING.
C                  ISTAD- ARRAY USED TO ORDER THE STATIONS FOR PLOTTING.
C                  ISTAP- ARRAY OF REARRANGED STATION NUMBERS.
C                  NFILE- COUNTS NUMBER OF FILES WHICH HAVE BEEN READ FRO
C                   TAPE.
C                  NREC  - COUNTS THE NUMBER OF RECORDS PROCESSED.
C                  PD    - DEPTH OF PLOTTING POINT FOR AM ARRAY.
C                  PINC  - INCREMENT OF PD.
C                  PMONTH- REAL*8 MONTH AND YEAR.
C                  WMONTH- REAL*8 MONTH AND YEAR ON TAPE.
C                  TP    - ARRAY OF TEMPS TO BE PLOTTED.
C
C
      DIMENSION T(400), ISTA(400), AM(13,20), CL(10), TP(400), ISTAP(400
     1), ISTAD(17)
      LOGICAL *1LTG(3)/.TRUE.,.TRUE.,.FALSE./
      DATA CL/6.5,7.0,7.5,8.0,8.5,9.0,9.5,10.0,11.0,12.0/
      REAL *8WMONTH,PMONTH,TITLE(12)
      DATA TITLE/'ISOTHERM','S       ','        ',9*'        '/
      DATA ISTAD/317,316,315,314,313,312,311,310,309,308,307,306,305,304
     1,303,302,301/
```

```
      READ (5,130) PMONTH,IFILE,NSTA,NSKIP1,NSKIP2
C      INITIALIZE VARIABLES.
      II = 0
      NFILE = 0
      NREC = 0
      PINC = 25.
   20 READ (8,140,END=60) ISTAA,WMONTH,JREC
      KOUNT = 0
      NREC = NREC+1
      PD = 0.
C
C
C
      DO 40 J=1,JREC
C      READ THE DEPTH AND TEMP DATA FOR THE ENTIRE STATION ONE AT A TIME
C      THE NEXT SIX 'IF' STATEMENTS CHECK THE DATA TO SEE IF IT IS TO BE
C      PLOTTED.
      READ (8,150) DE,TE
      IF ((ISTAA.LT.300).OR.(ISTAA.GT.400)) GO TO 40
      IF (ISTAA.EQ.309) GO TO 40
      IF ((NREC.EQ.NSKIP1).OR.(NREC.EQ.NSKIP2)) GO TO 40
      IF (WMONTH.NE.PMONTH) GO TO 40
      IF (DE.GT.300.) GO TO 40
      IF (DE.GE.PD) GO TO 30
      GO TO 40
C      STORE THE DESIRED DATA FOR PLOTTING UNTIL ALL DATA POINTS HAVE
C      HAVE BEEN READ.
   30 II = II+1
      KOUNT = KOUNT+1
      T(II) = TE
      ISTA(II) = ISTAA
      PD = PD+PINC
      IF (PD.EQ.300.) PD = 295.
      TITLE(3) = WMONTH
   40 CONTINUE
C
C
C
      WRITE (6,190) KOUNT,NREC
      IF (KOUNT.LT.13) GO TO 50
      GO TO 20
   50 II = II-KOUNT
      WRITE (6,160) ISTAA
      GO TO 20
   60 CONTINUE
C      SEE IF MORE THAN ONE FILE IS TO BE READ FROM THE TAPE.
      NFILE = NFILE+1
      IF (NFILE.LT.IFILE) GO TO 20
```

```
      WRITE (6,170)
      WRITE (6,200) TITLE(3)
      K = 0
C
C
C      REARRANGE THE DATA FOR PLOTTING SUCH THAT THE STATION NUMBERS ARE
C      CRDERED FROM THE HIGHEST TO THE LOWEST. THIS WILL PUT THE
C      STATIONS IN ORDER FROM WEST TO EAST.
C
      DO 90 I=1,17
C
C
C
      DO 80 J=1,II
      IF (ISTA(J).EQ.ISTAD(I)) GO TO 70
      GO TO 80
   70 K = K+1
      TP(K) = T(J)
      ISTAP(K) = ISTA(J)
   80 CONTINUE
C
C
C
   90 CCNTINUE
C
C
C
C      INITIALIZE THE PLOTTING ARRAY.
C
C
C
      DO 100 I=1,13
C
C
C
      DO 100 J=1,20
      AM(I,J) = 0.
  100 CCNTINUE
C
C
C
C      FILL THE PLOTTING ARRAY WITH THE DATA POINTS.
      K = 0
C
C
C
      DO 120 J=1,NSTA
C
```

```
C
C
      DO 110 I=1,13
      K = K+1
      AM(I,J) = TP(K)
  110 CONTINUE
C
C
C
  120 CONTINUE
C
C
C
      WRITE (6,180) ((AM(I,J),J=1,NSTA),I=1,13)
      CALL CONTUR (AM,13,NSTA,13,CL,10,TITLE,8,3,LTG)
      STOP
C
C
C
  130 FORMAT (3X,A9,I2,3I3)
  140 FORMAT (I4,A9,I6,1X)
  150 FORMAT (F8.2,F6.2,6X)
  160 FORMAT (3X,'STATION',I6,' IS LESS THAN 295 METERS DEEP')
  170 FORMAT (3X,'THIS IS END OF TAPE READ')
  180 FORMAT (3X,15F8.3)
  190 FORMAT (3X,'KOUNT=',I5,3X,'NREC=',I5)
  200 FORMAT (75X,A8//)
      END
```

APPENDIX G

```
C TITLE          STDPLT
C
C PROGRAMER      R.E.BLUMBERG
C
C DOCUMENTATION  R.E.BLUMBERG
C
C DATE           12 AUGUST 1975
C
C PURPOSE        STDPLT IS COMPATIBLE WITH THE FORMAT WRITTEN ON THE 9-
C                 TRACK TAPE BY DIGISTD. THIS PROGRAM READS DEPTH,
C                 TEMP, AND SALINITY DATA FROM THE 9-TRACK TAPE, AND
C                 RETAINS THE TEMP, DEPTH, AND STATION NUMBER OF THOSE
C                 STATIONS WITH SUFFICIENT SPECIFIED DEPTH AND WITH THE
C                 DESIRED LOCATION  WHICH ARE TO BE PLOTTED. STDPLT USES
C                 SUBROUTINE CONTUR FROM THE W.R. CHURCH COMPUTER CENTER
C                 SUBROUTINE LIBRARY.
C ARGUMENTS      SEE THE SUBROUTINE LIBRARY FOR A DESCRIPTION OF THE
C                 VARIABLES USED IN THE SUBROUTINE CONTUR. THE FOLLOWING
C                 IS A BRIEF DESCRIPTION OF THE IMPORTANT ARRAYS AND
C                 VARIABLES:
C                 AM    - THE PLOTTING ARRAY USED IN CONTUR
C                 IFILE- NUMBER OF FILES DESIRED TO BE READ FROM TAPE.
C                 ISTA  - ARRAY OF STATION NUMBERS READ AND RETAINED  FOR
C                  PLOTTING.
C                 ISTAD- ARRAY USED TO ORDER THE STATIONS FOR PLOTTING.
C                 ISTAP- ARRAY OF REARRANGED STATION NUMBERS.
C                 NFILE- COUNTS NUMBER OF FILES WHICH HAVE BEEN READ FRO
C                  TAPE.
C                 NREC  - COUNTS THE NUMBER OF RECCRDS PROCESSED.
C                 PD    - DEPTH OF PLOTTING POINT FOR AM ARRAY.
C                 PINC  - INCREMENT OF PD.
C                 PMONTH- REAL*8 MONTH AND YEAR.
C                 WMONTH- REAL*8 MONTH AND YEAR ON TAPE.
C                 TP    - ARRAY OF TEMPS TO BE PLOTTED.
C
C
       DIMENSION SIGMT(400), SIGMP(400), T(400), ISTA(400), ISTAD(17), AM
      1(20,20), BM(20,20), CL(10), DL(5), TP(400), ISTAP(400)
       LCGICAL *1LTG(3)/.TRUE.,.TRUE.,.FALSE./
       REAL *8WMONTH,PMONTH,TITLE(12),BTITL(12)
       DATA CL/6.5,7.0,7.5,8.0,8.5,9.0,9.5,10.0,11.0,12.0/,DL/26.1,26.3,2
      16.5,26.7,26.9/
       DATA TITLE/'ISOTHERM','S       ','        ',9*'        '/
       DATA BTITL/'CONSTANT',' SIGMA T',' SURFACE','S       ','        ',
```

```
      17*'          '/
      CATA ISTAD/317,316,315,314,313,312,311,310,309,308,307,306,305,304
     1,303,302,301/
      READ (5,130) PMONTH,IFILE,NSTA,NSKIP1,NSKIP2
C      INITIALIZE VARIABLES.
      II = 0
      NFILE = 0
      NREC = 0
      PINC = 25.
   20 READ (8,140,END=60) ISTAA,WMONTH,JREC
      KCUNT = 0
      NREC = NREC+1
      PC = 0.
C
C
C
      DO 40 J=1,JREC
C      READ THE D,T,S,SIGMA T, SV DATA FOR THE ENTIRE STATION ONE AT A
C      TIME. THE NEXT SIX 'IF' STATEMENTS CHECK THE DATA TO SEE IF IT IS
C      TO BE PLOTTED.
      READ (8,150) DE,TE,SA,SV,SIGMA
      IF ((ISTAA.LT.300).OR.(ISTAA.GT.400)) GO TO 40
      IF ((NREC.EQ.NSKIP1).OR.(NREC.EQ.NSKIP2)) GO TO 40
      IF (WMONTH.NE.PMONTH) GO TO 40
      IF (DE.GT.500.) GO TO 40
      IF (DE.GE.PD) GO TO 30
C      STORE THE DESIRED DATA FOR PLOTTING UNTIL ALL DATA POINTS HAVE
C      HAVE BEEN READ.
      GO TO 40
   30 II = II+1
      KCUNT = KOUNT+1
      ISTA(II) = ISTAA
      T(II) = TE
      SIGMT(II) = SIGMA
      PC = PD+PINC
      TITLE(3) = WMONTH
      BTITL(5) = WMONTH
   40 CCNTINUE
C
C
C
      WRITE (6,200) KOUNT,NREC
      IF (KOUNT.LT.20) GO TO 50
      GC TO 20
   50 II = II-KOUNT
      WRITE (6,160) ISTAA
      GC TO 20
   60 CCNTINUE
```

```
C      SEE IF MORE THAN ONE FILE IS TO BE READ FRCM THE TAPE.
      NFILE = NFILE+1
      IF (NFILE.LT.IFILE) GO TO 20
      WRITE (6,170)
      WRITE (6,210) TITLE(3)
      K = 0
C
C
C      REARRANGE THE DATA FOR PLOTTING SUCH THAT THE STATICN NUMBERS ARE
C      CRDERED FROM THE HIGHEST TO THE LOWEST. THIS WILL PUT THE
C      STATIONS IN ORDER FROM WEST TO EAST.
C
      DC 90 I=1,17
C
C
C
      DO 80 J=1,II
      IF (ISTA(J).EQ.ISTAD(I)) GO TO 70
      GO TO 80
   70 K = K+1
      ISTAP(K) = ISTA(J)
      TP(K) = T(J)
      SIGMP(K) = SIGMT(J)
   80 CCNTINUE
C
C
C
   90 CONTINUE
C
C
C
C      INITIALIZE THE PLOTTING ARRAY.
C
C
C
      DO 100 I=1,20
C
C
C
      DO 100 J=1,20
      AM(I,J) = 0.
      BM(I,J) = 0.
  100 CCNTINUE
C
C
C
C      FILL THE PLOTTING ARRAY WITH THE DATA POINTS.
      K = 0
```

```
C
C
C
      DO 120 J=1,NSTA
C
C
C
      DO 110 I=1,20
      K = K+1
      AM(I,J) =  TP(K)
      BM(I,J) =  SIGMP(K)
  110 CONTINUE
C
C
C
  120 CONTINUE
C
C
C
      WRITE (6,180) ((AM(I,J),J=1,NSTA),I=1,20)
      CALL CONTUR (AM,20,NSTA,20,CL,10,TITLE,8,5,LTG)
C       CONTUR IS CALLED THIS SECOND TIME TO PLOT LINES OF CONSTANT
C       SIGMA T. THIS ALLOWS THE OPERATOR TO MANUALLY TRACE THE
C       SIGMA T SURFACES ONTO THE GRAPH OF THE ISOTHERMS AT A LATER TIME.
C       THIS IS NECESSARY SINCE ONE IS UNABLE TO DRAW BOTH ISOTHERMS AND
C       SIGMA T ON THE SAME GRAPH USING THIS SUBROUTINE.
      WRITE (6,190) ((BM(I,J),J=1,NSTA),I=1,20)
      CALL CONTUR (BM,20,NSTA,20,DL,5,BTITL,8,5,LTG)
      STOP
C
C
C
  130 FORMAT (A12,I2,3I3)
  140 FORMAT (I5,A12,I6,17X)
  150 FORMAT (F6.2,2F6.3,F7.2,F7.4,8X)
  160 FORMAT (3X,'STATION',I6,' IS LESS THAN 475 METERS DEEP')
  170 FORMAT (3X,'THIS IS END OF TAPE READ')
  180 FORMAT (3X,16F8.3)
  190 FORMAT (3X,16F8.4)
  200 FORMAT (3X,'KOUNT=',I5,3X,'NREC=',I5)
  210 FORMAT (75X,A8//)
      END
```

APPENDIX H

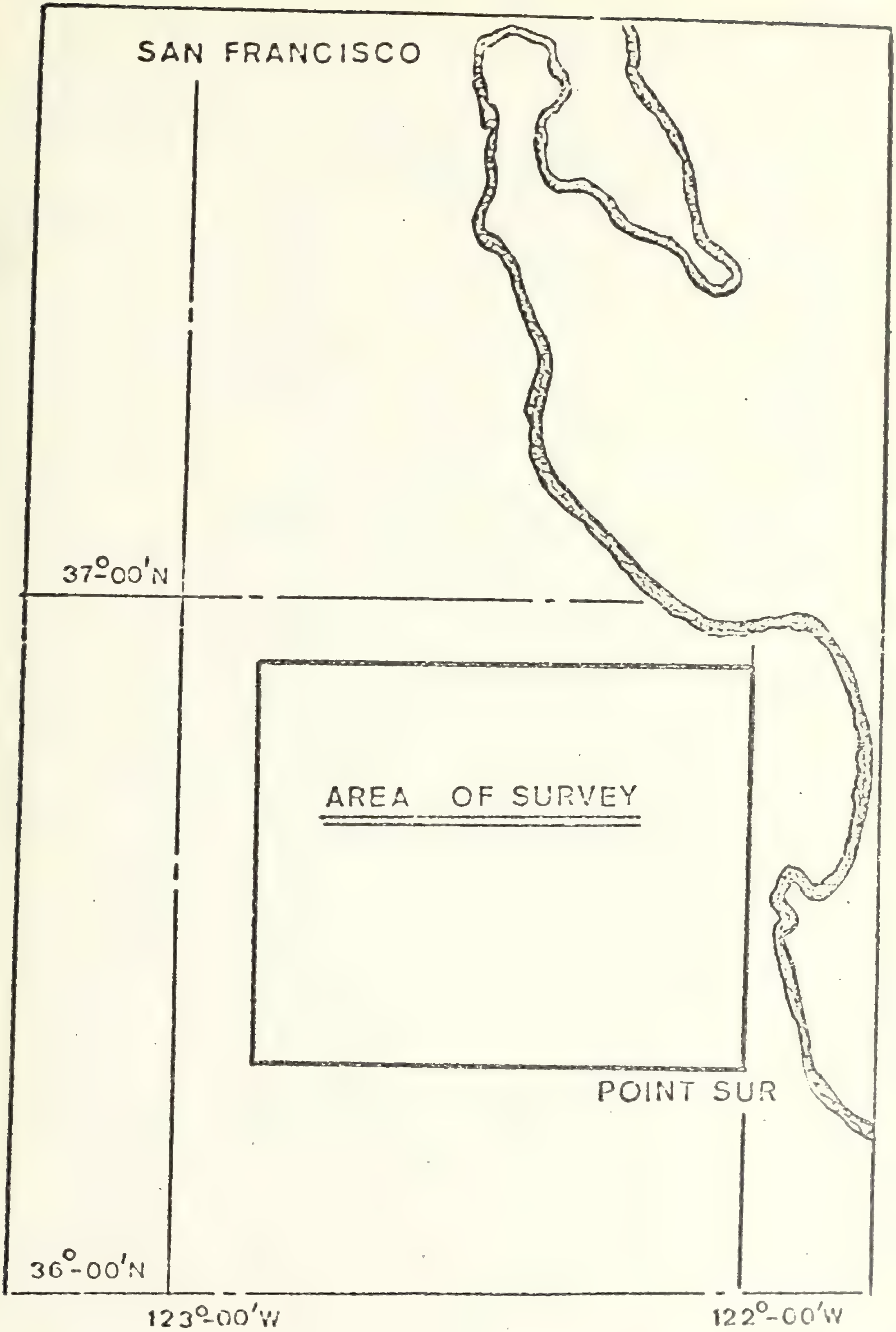
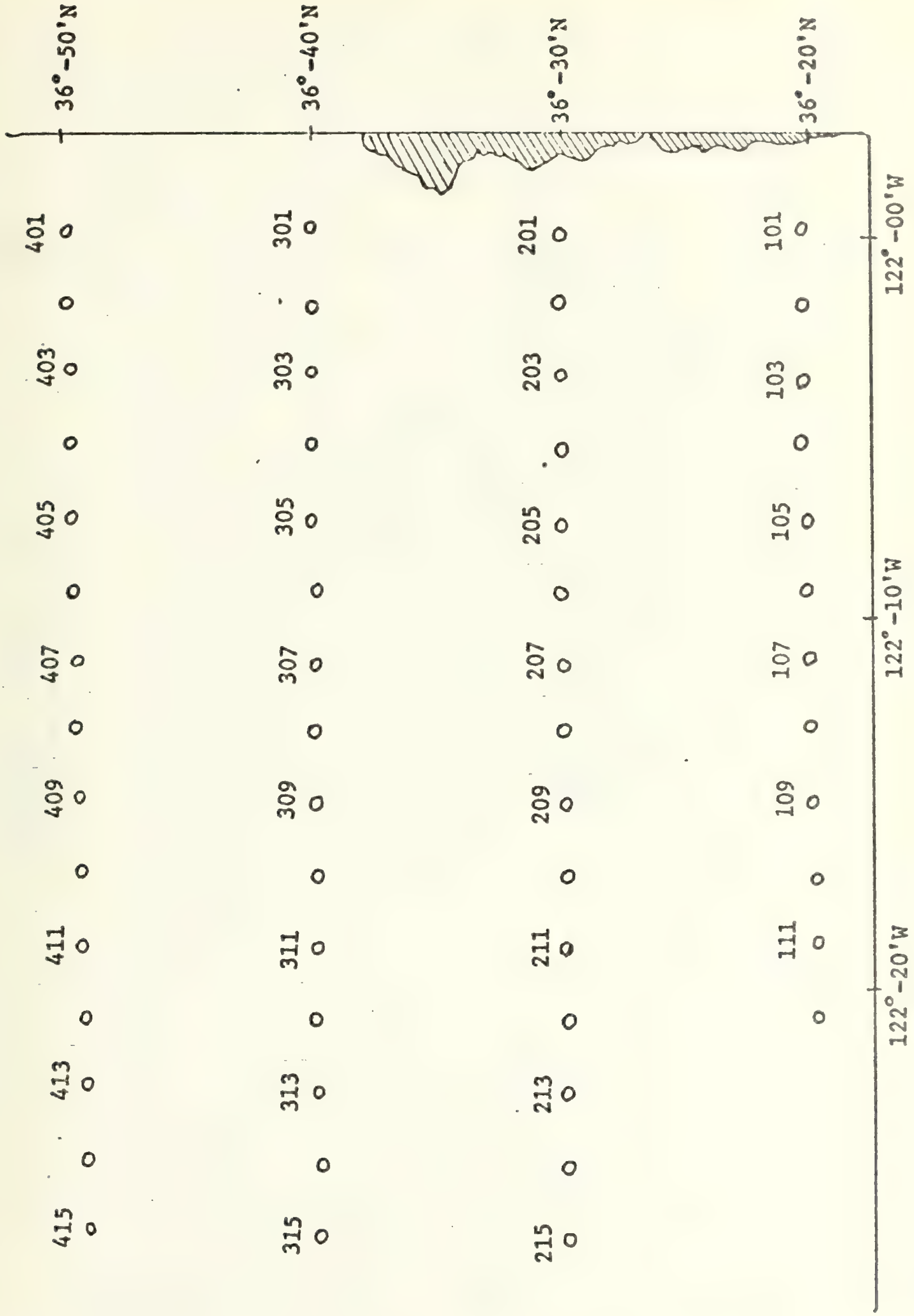

SAN FRANCISCO
37°00'N
AREA OF SURVEY
POINT SUR
36°-00'N
123°-00'W
122°-00'W

Fig. 1 Area of Survey.


36°-50'N
36°-40'N
36°-30'N
36°-20'N
122°-00'W
122°-10'W
122°-20'W
401
403
405
407
409
411
413
415
301
303
305
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107
109
111

Fig. 2 Station Locations.

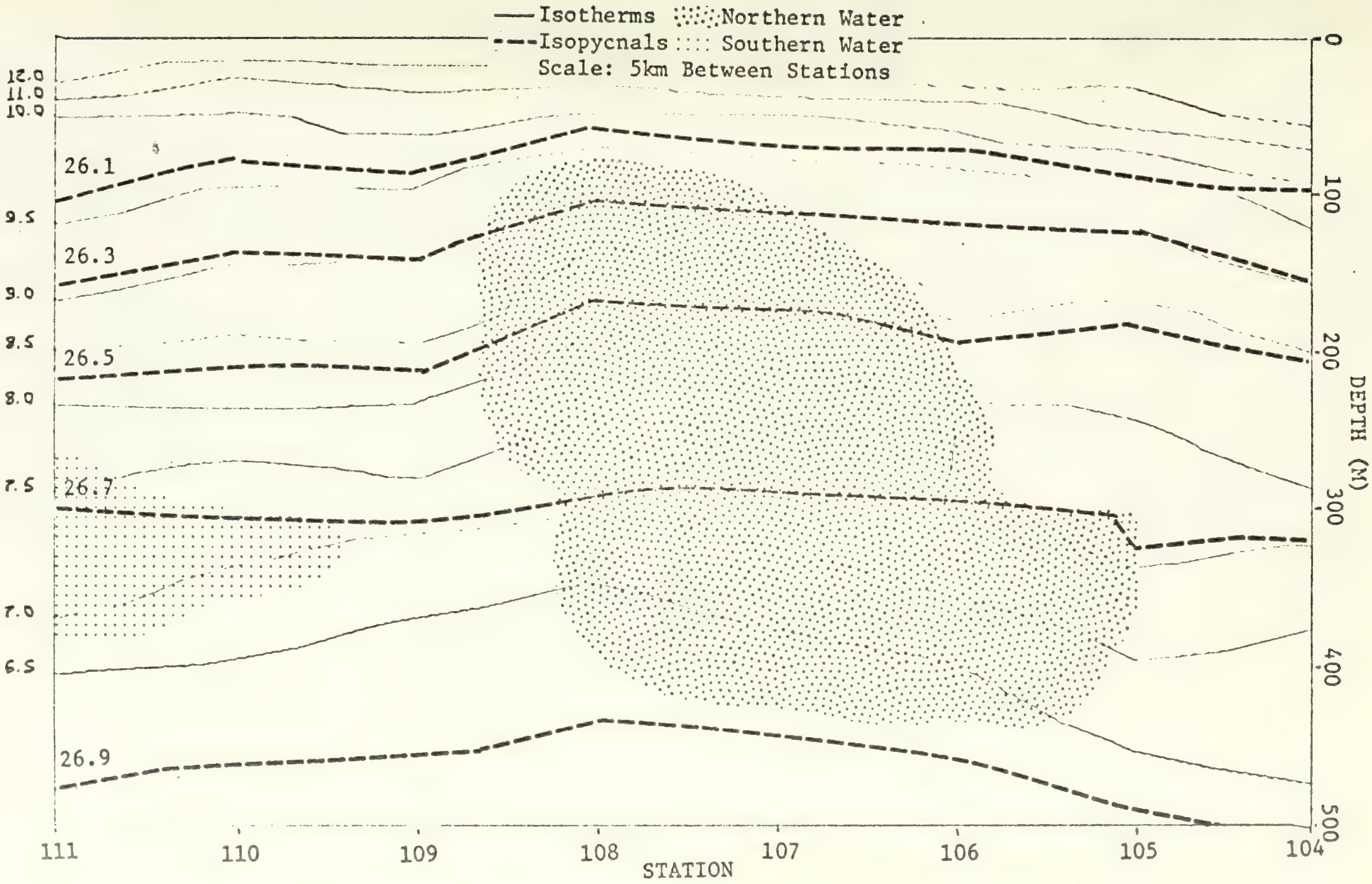

Fig. 3 Isotherms and Constant Sigma t Surfaces, Aug 1973.

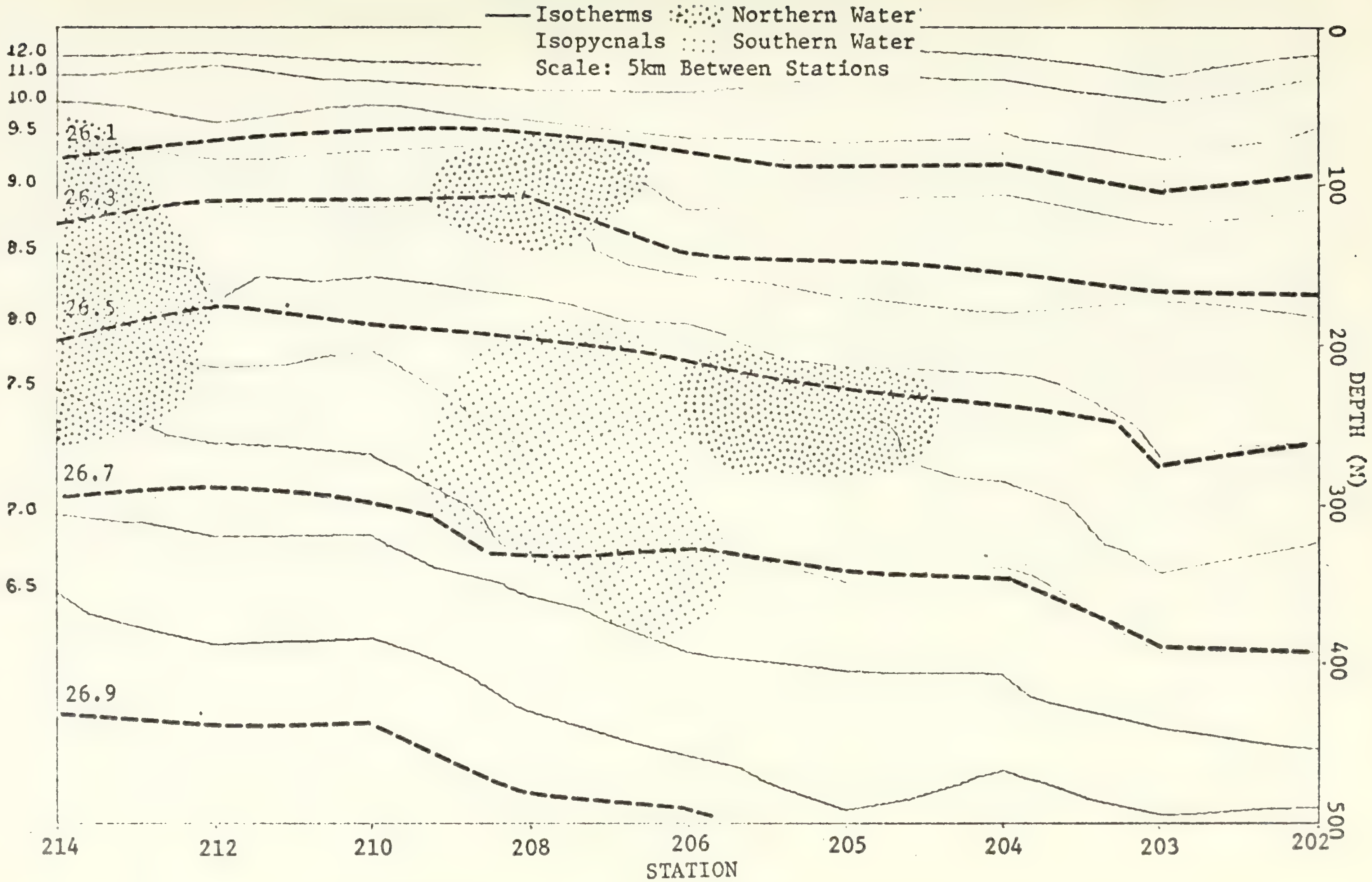

Fig. 4 Isotherms and Constant Sigma t Surfaces, Aug 1973.

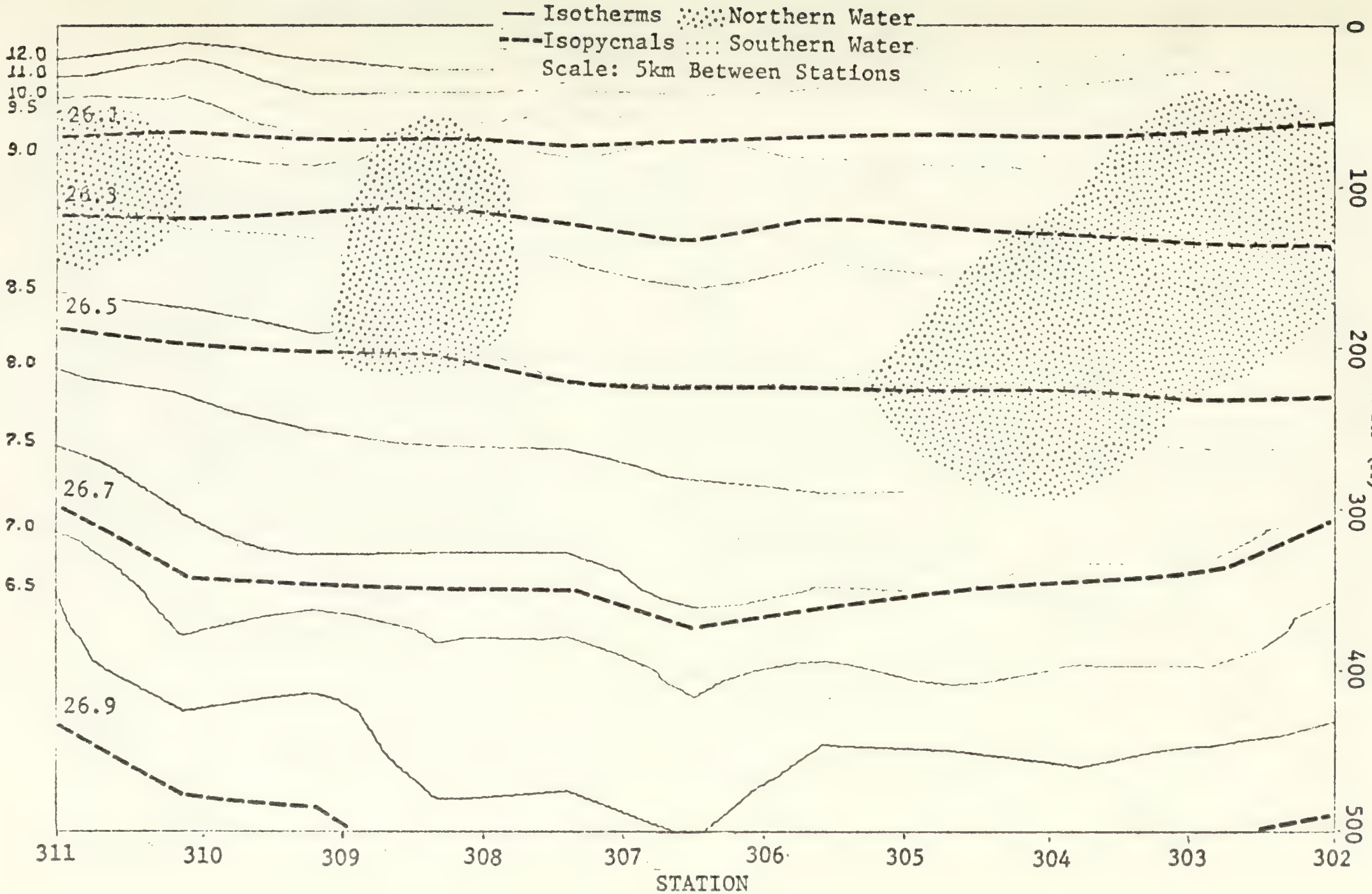

Fig. 5 Isotherms and Constant Sigma t Surfaces, Aug 1973.

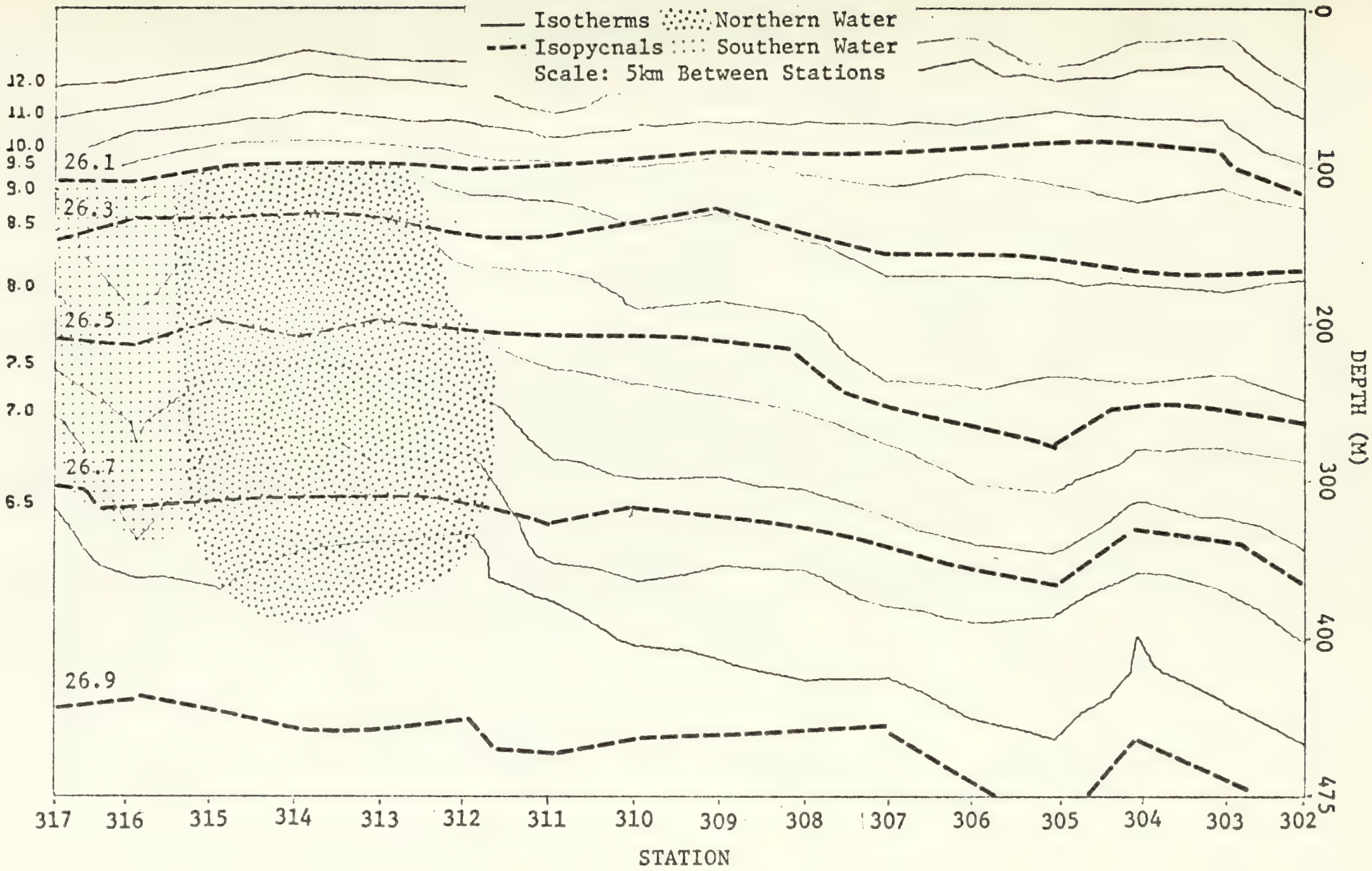

Fig. 6 Isotherms and Constant Sigma t Surfaces, Oct 1973.

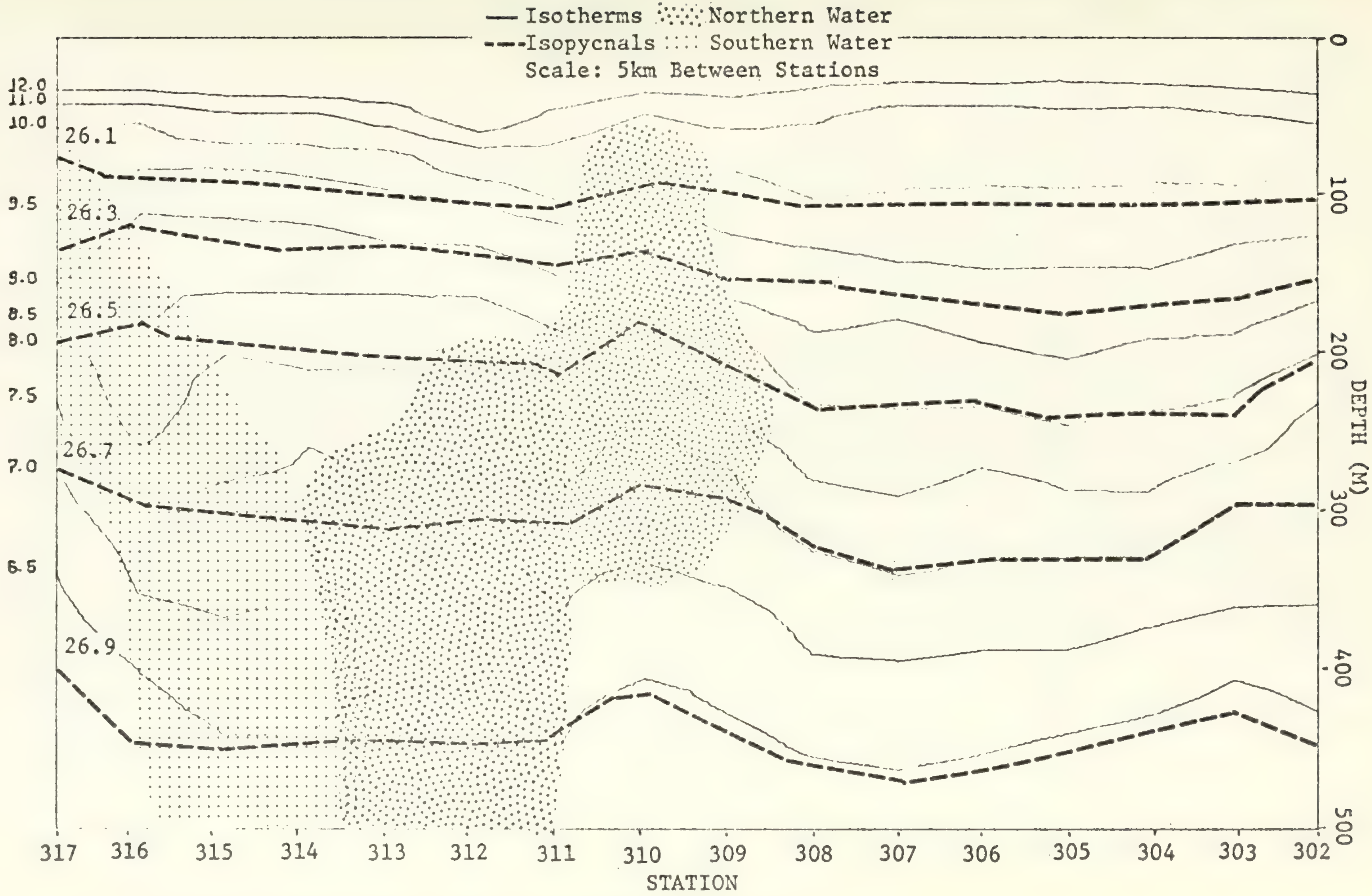

Fig. 7 Isotherms and Constant Sigma t Surfaces, Nov 1973.

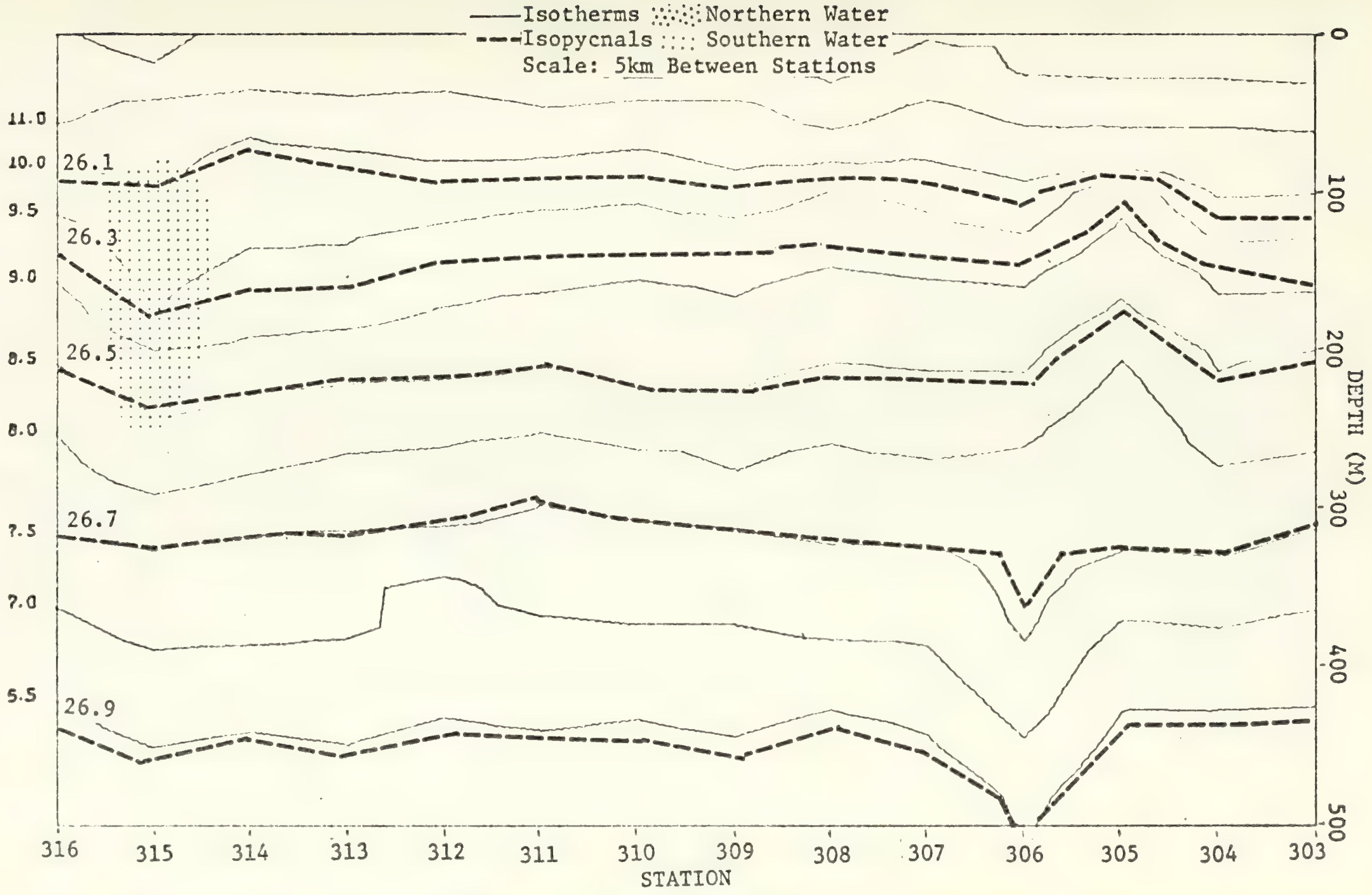

Fig. 8 Isotherms and Constant Sigma t Surfaces, Dec 1973.

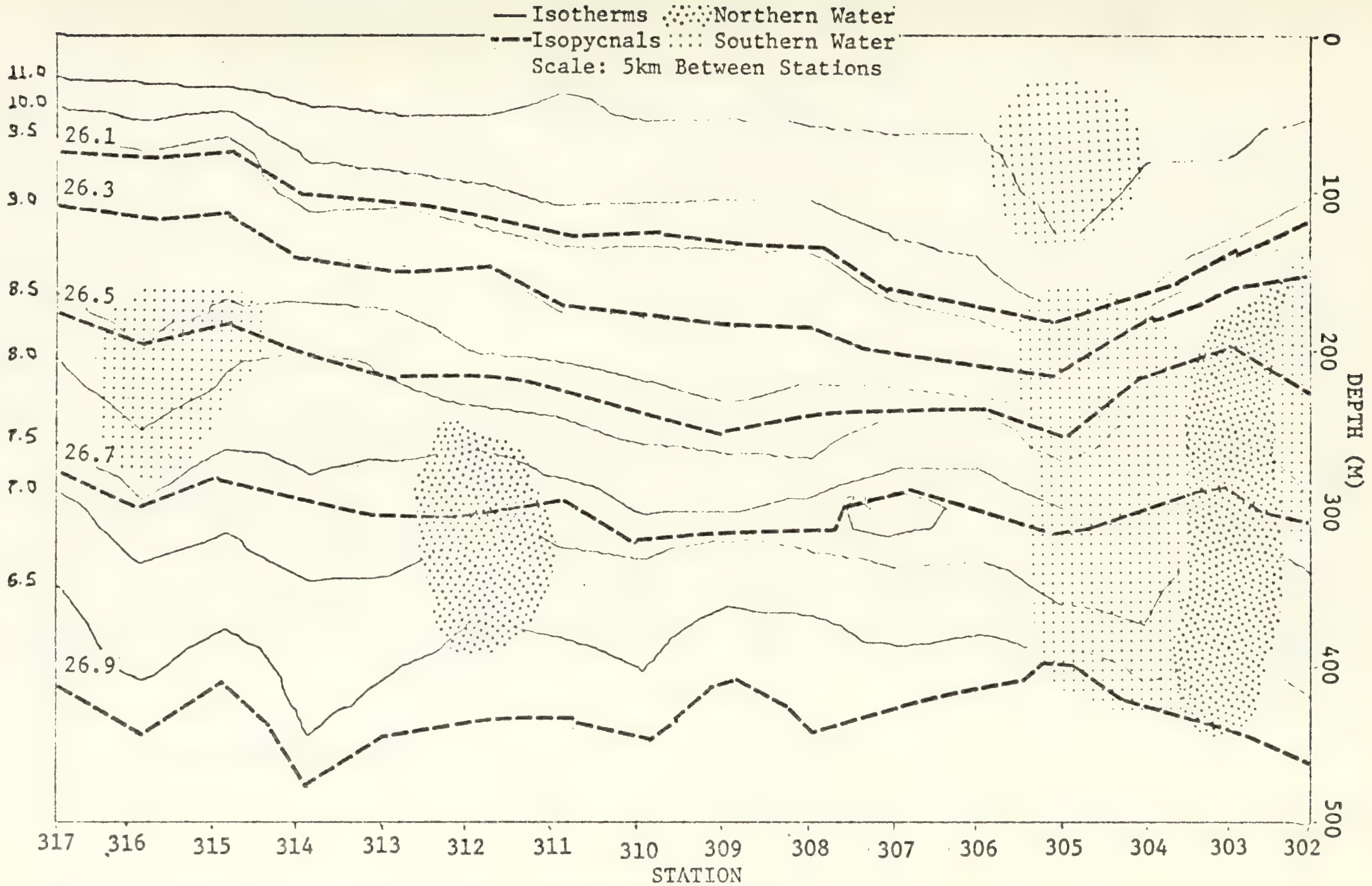

Fig. 9 Isotherms and Constant Sigma t Surfaces, Jan 1974.

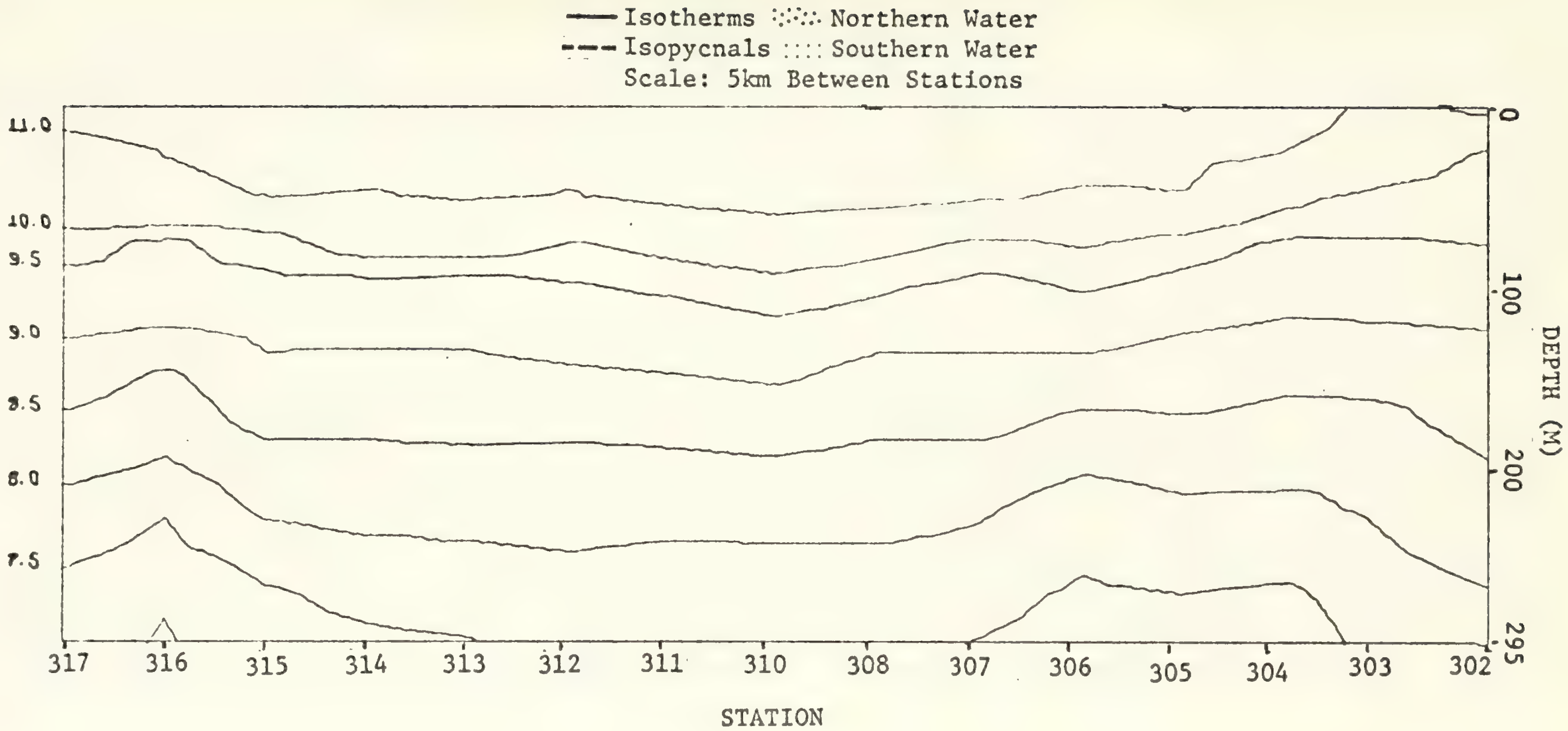

Fig. 10 Isotherms, Feb 1974.

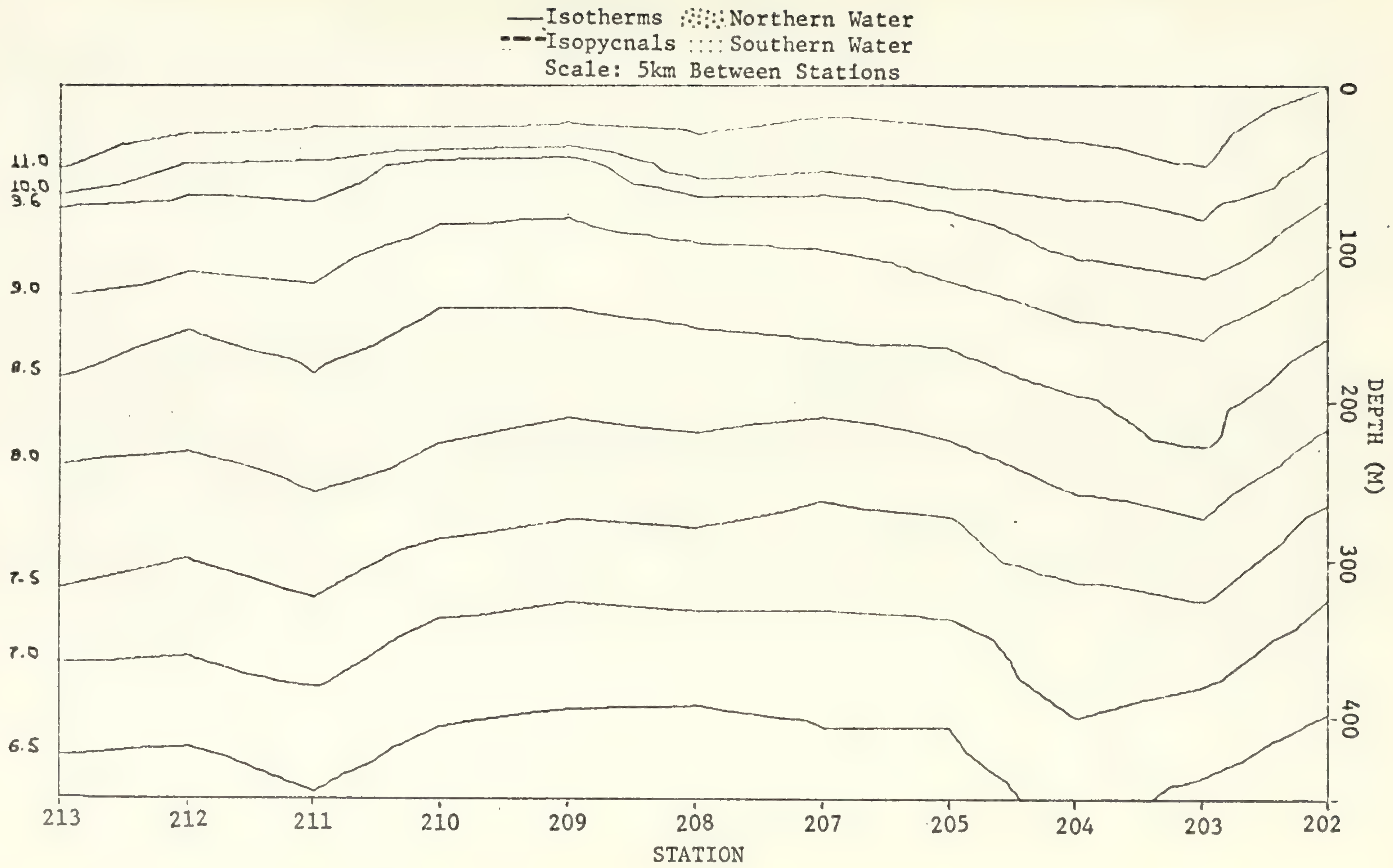

Fig. 11 Isotherms, Mar 1974.

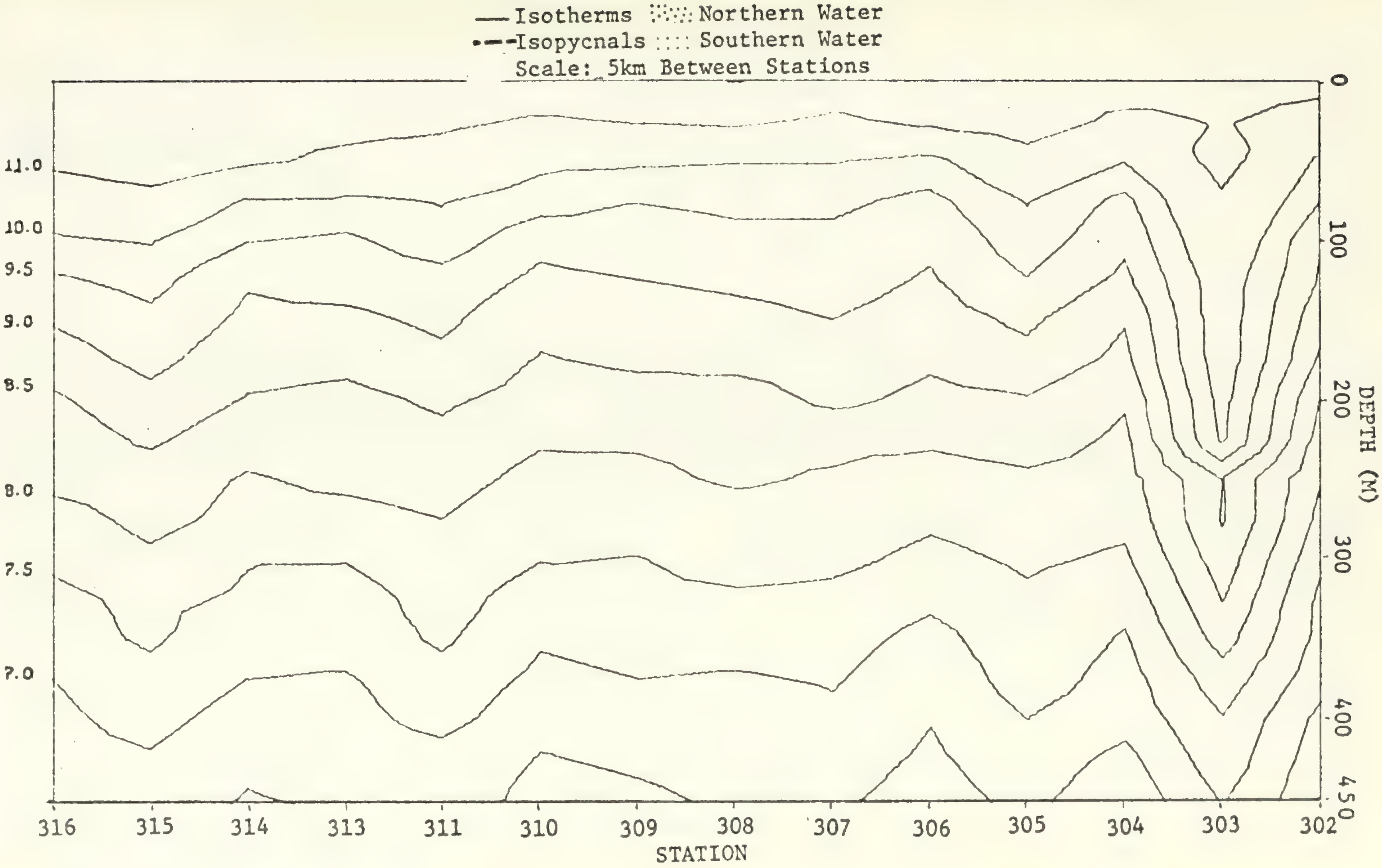

Fig. 12 Isotherms, Mar 1974.

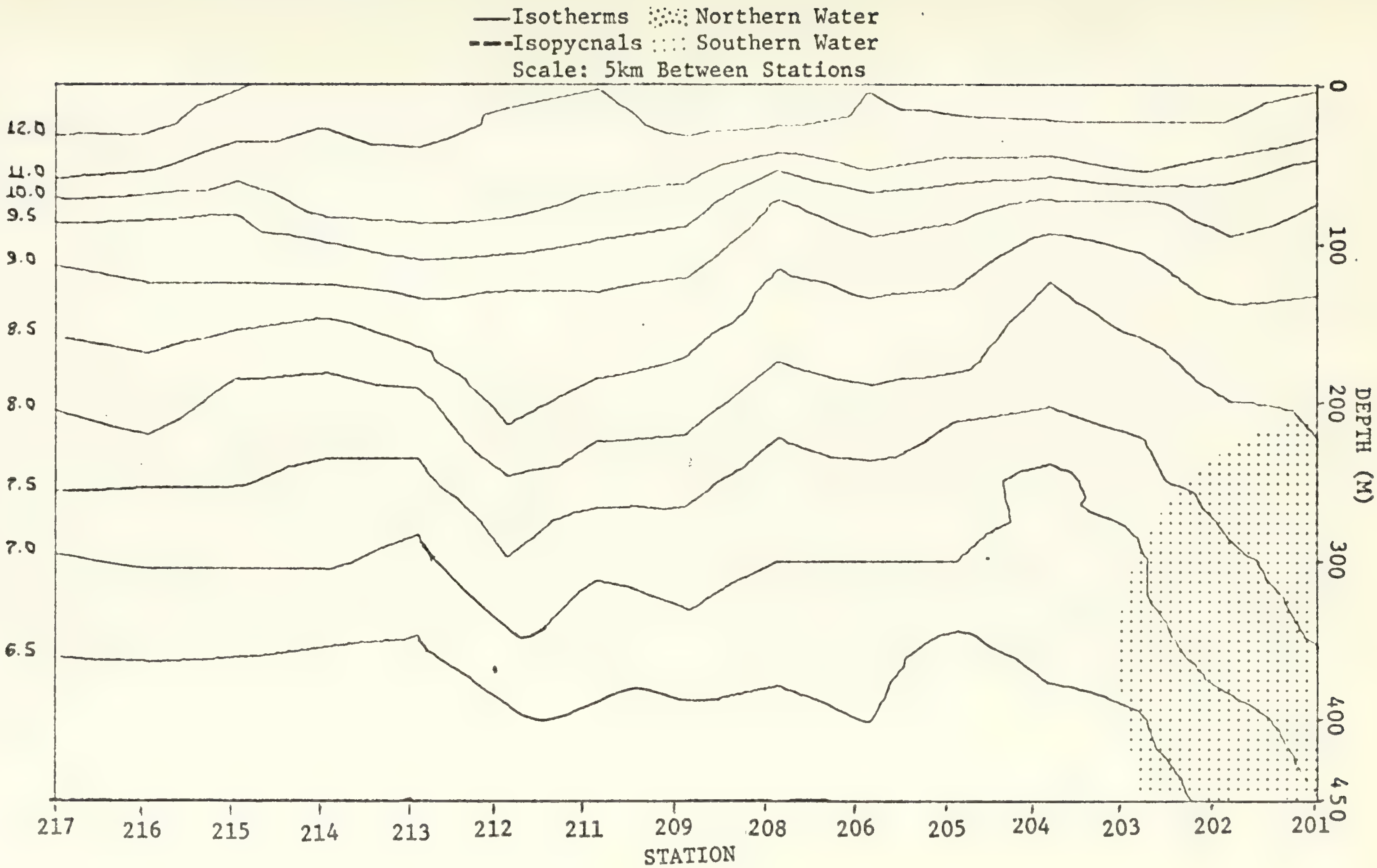

Fig. 13 Isotherms, May 1974.

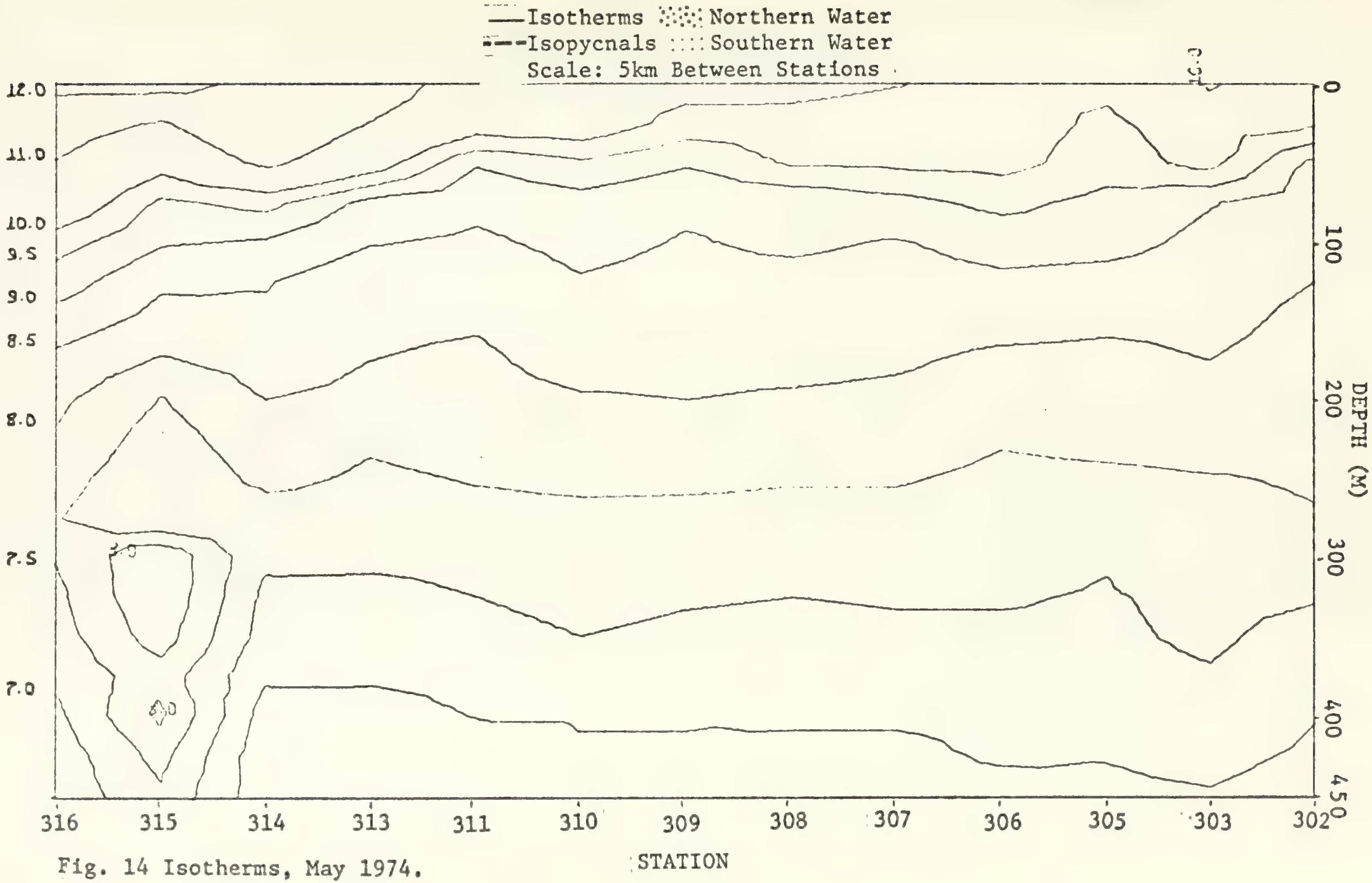

Fig. 14 Isotherms, May 1974.

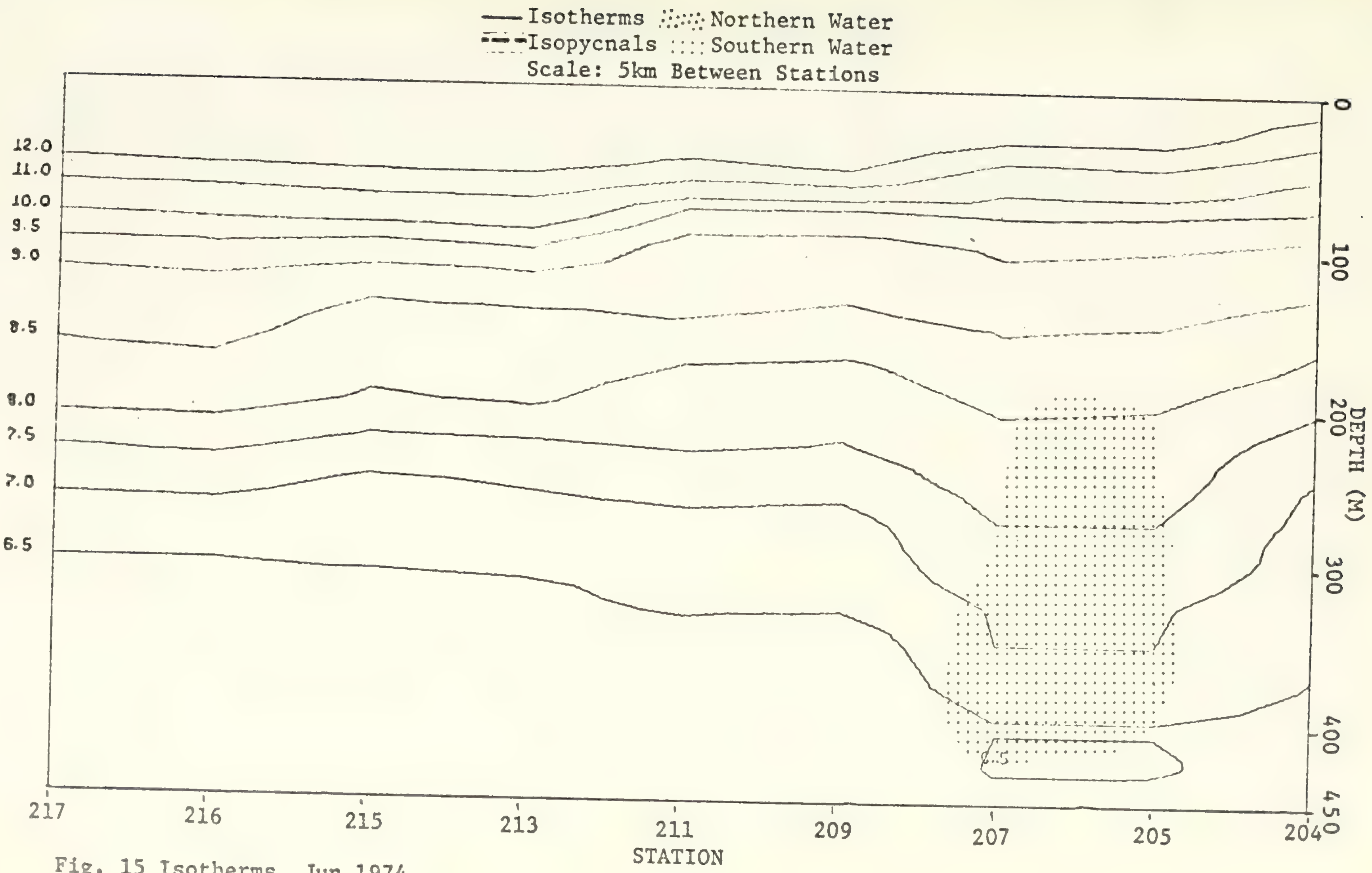

Fig. 15 Isotherms, Jun 1974.

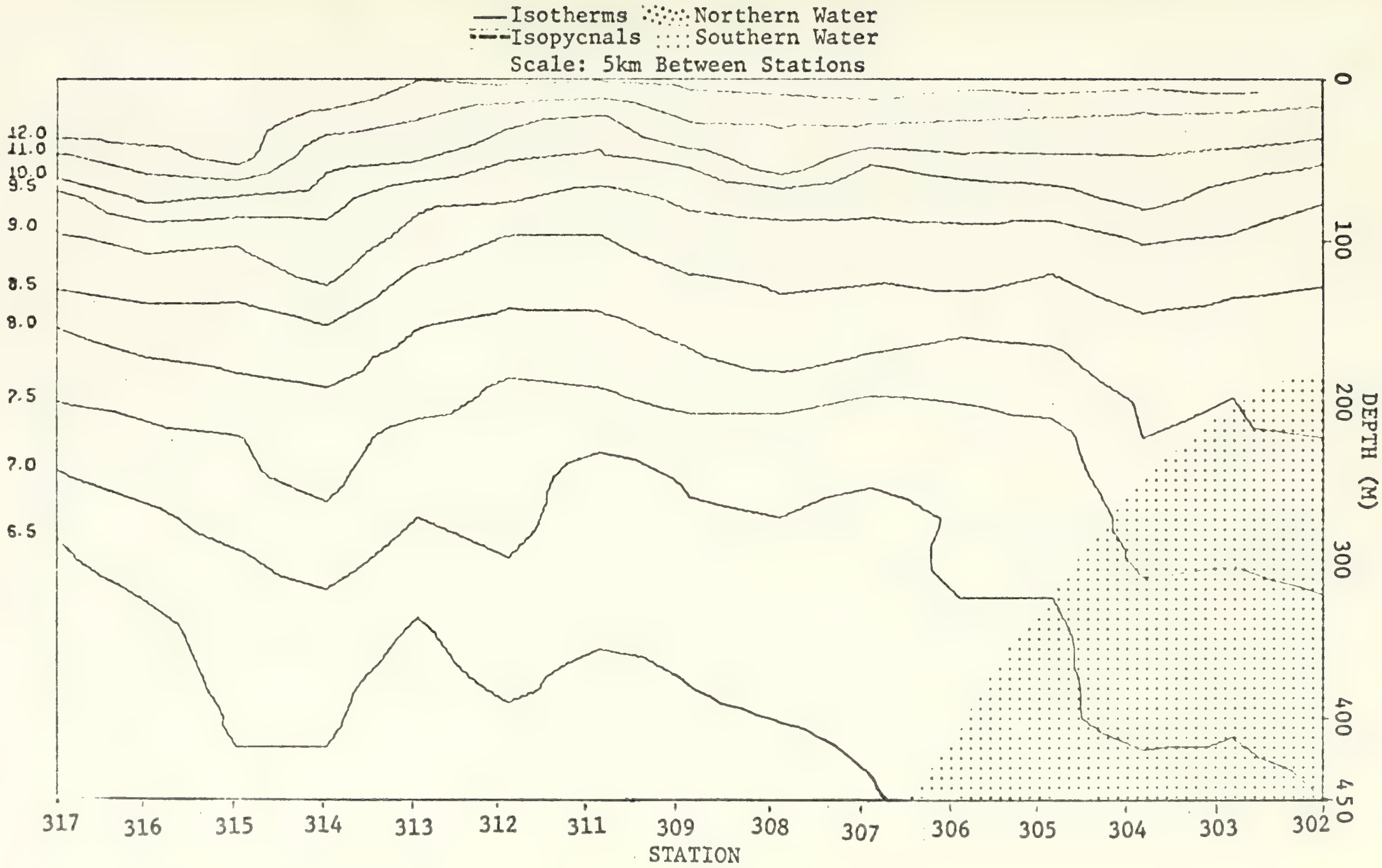

Fig. 16 Isotherms, Jun 1974.

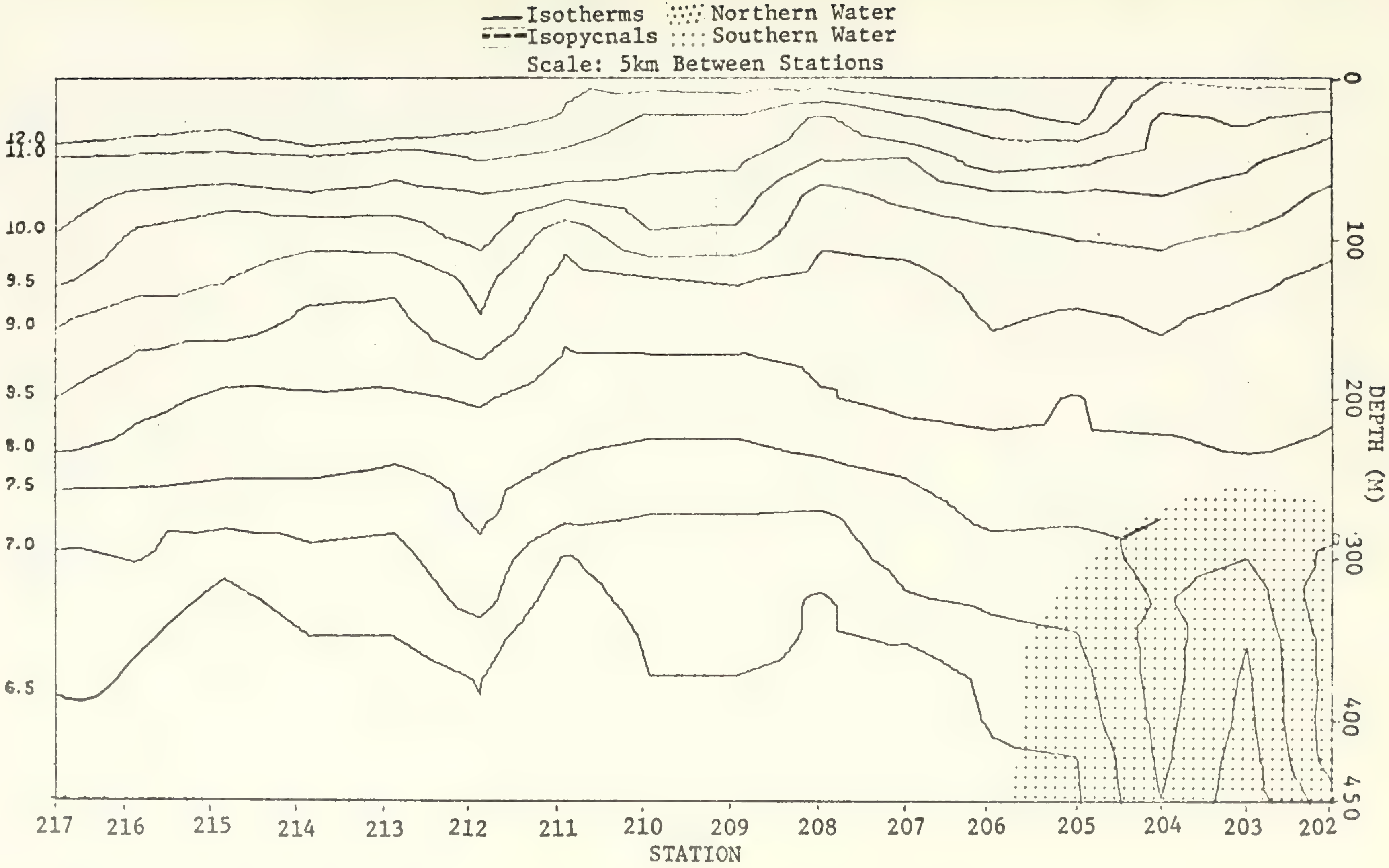

Fig. 17 Isotherms, Jul 1974.

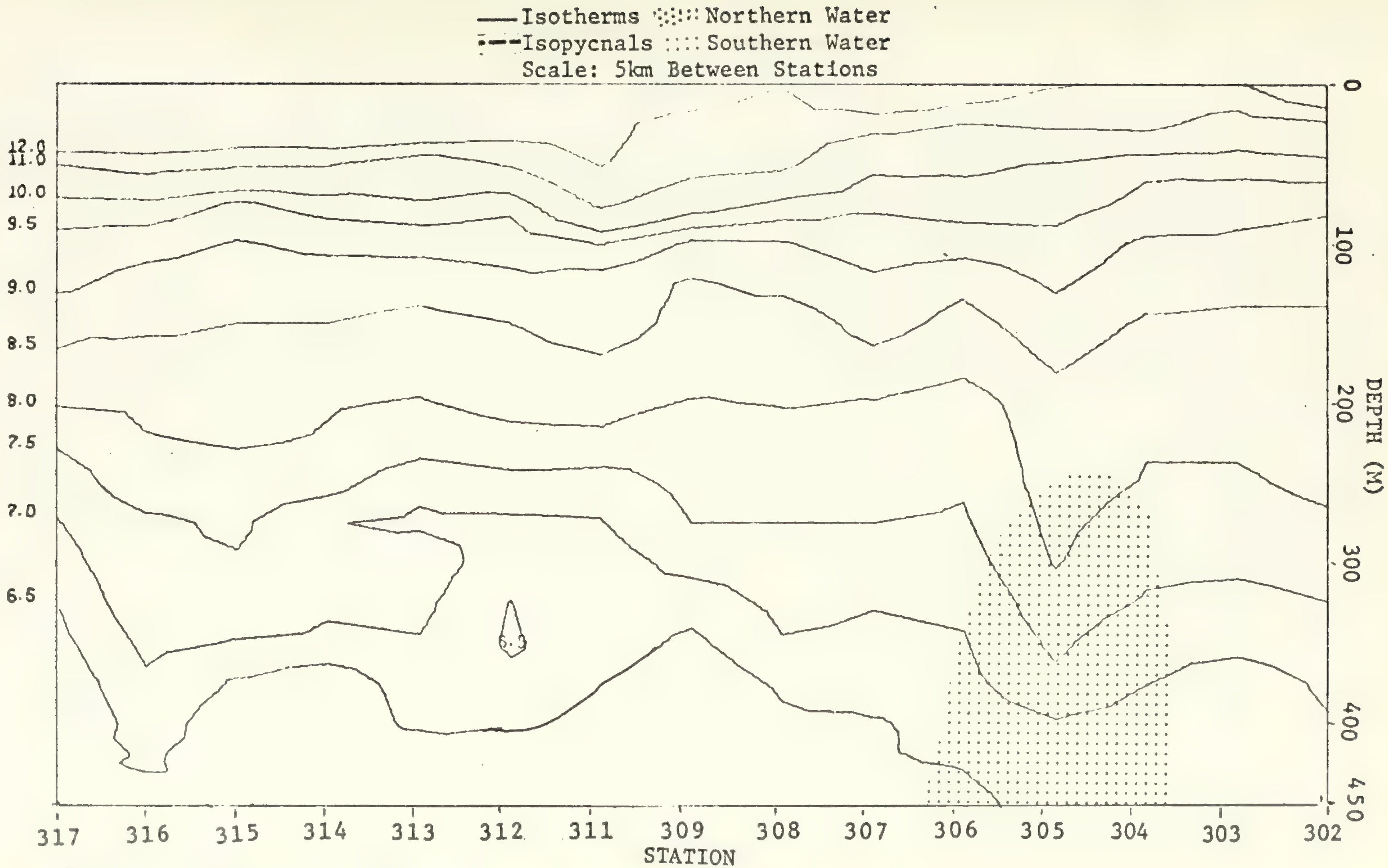

Fig. 18 Isotherms Jul 1974.

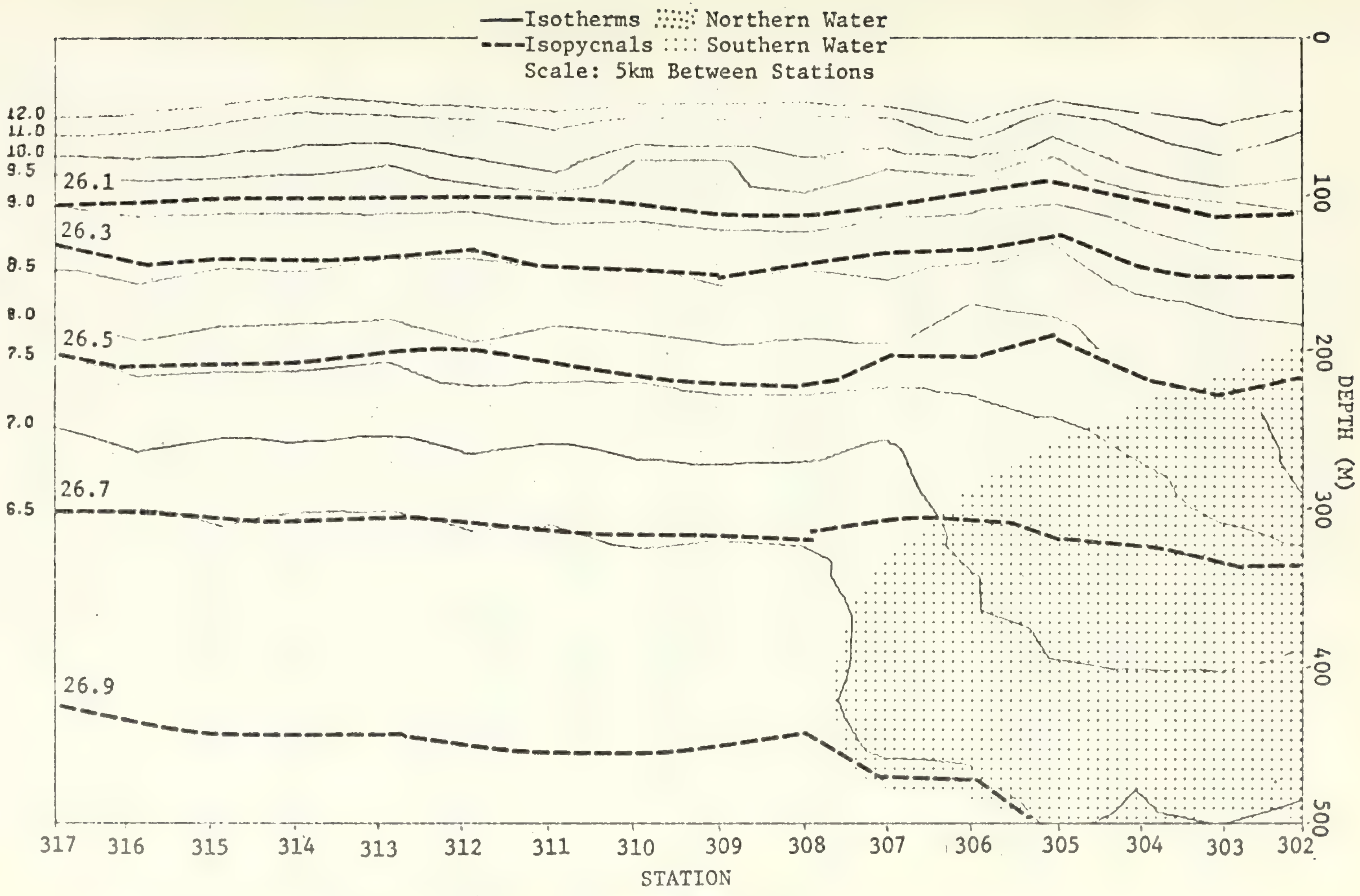

Fig. 19 Isotherms and Constant Sigma t Surfaces, Aug 1974.

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